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ABSTRACT

This report presents existing workforce levels, training programs and career potentials and develops staffing level projections (1976-1982) based on available information for the State of Illinois. The study concerns itself with the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, wastewater, and energy. The format includes workforce profiles, projections, growth and career options for each of the areas investigated. Additional sections of the report outline state legislation and selected post secondary institutions with formal Environmental/Energy programs. A state profile and summary is included for cross-reference. The selected bibliography is appended in the Region V report. This document is one in a series of 69 which presents information for each of the states, Washington, D.C., Puerto Rico, and the Virgin Islands, and national and regional summaries. (CS)

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ED147121

A National Environmental/Energy Workforce Assessment

ILLINOIS

Conducted by:

National Field Research Center, Inc.
P.O. Box 287
Iowa City, Iowa 52240

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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NATIONAL ENVIRONMENTAL/ENERGY
WORKFORCE ASSESSMENT

for

ILLINOIS

Conducted by:
NATIONAL FIELD RESEARCH CENTER, INC

Under Grant from:
UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
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INTRODUCTORY NOTE

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PREFACE

This report presents existing workforce levels, training programs, career potentials, and staffing level projections (1976-1981) based on available information for the State of Illinois in the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, wastewater, and energy. This study was carried out for the United States Environmental Protection Agency by the National Field Research Center, Inc., of Iowa City, Iowa.

The information and data presented in this report were compiled in large part from extensive on-site interviews with professionals working in the respective areas and were supplemented by telephone surveys and research.

FOREWORD

This report is a compilation of the information and data collected for eight individual pollution control inventories conducted for Illinois. The format includes workforce profiles, projections growth and career potential for each of the areas investigated. Growth projections are necessarily based on best professional estimates developed from available information and represent what are felt to be realistic figures by experts in the respective areas. The pollution control areas considered by this study are as follows:

Air
Noise
Pesticides
Potable Water
Radiation
Solid Waste
Wastewater
Energy

This report is an up-date and expansion of the environmental/energy workforce assessment for Illinois conducted by National Field Research Center, Inc., of Iowa City, Iowa, for the United States Environmental Protection Agency in conjunction with the Illinois Board of High Education. The original study was published in early 1975.

Several differences exist between this and the first report. Most obvious is the inclusion of extensive sections on radiation and energy which were not part of the 1975 study. Projections have been extended through 1981 for all program areas. Some programs (most notably air) are shown to have little or no change in program emphasis and activities and consequently little change indicated in projected workforce levels. This is probably because mature programs were in effect when the first study was undertaken. Others (particularly pesticides and wastewater), are seen to be undergoing substantial changes resulting from recent federal legislation, as was predicted in the 1975 study. Potable water is a particularly difficult area to assess in terms of even the short-term future as the effects of the Safe Drinking Water Act are yet to be determined. Major differences in workforce projection figures are due to legislation implemented subsequent to the first Illinois report and reflect information which was not available at the time the first report was written.

National Environmental Energy Workforce Assessment

Phase I

ILLINOIS

State Summary

I. AIR

Air pollution control and abatement activities in Illinois are the responsibility of the Air Pollution Control Division of the Illinois Environmental Protection Agency. The Agency's mandate covers stationary sources and vehicular emissions.

The current staffing level of the Division's two branches is 130. Engineers continue to dominate the employment profile, although their numbers have been reduced from 69 in 1974 to 55 in 1976. The loss in engineering positions has been offset by increases in the technician category. This trend is thought to have leveled off. Future increases are expected to be about equal (though small) for engineers, technicians, and meteorologists and scientists.

Division supervisiory personnel anticipate a staffing increase of approximately two percent per annum over the next five years. Budgetary constraints and the mature status of the air program combine to create a situation in which monies available will be channeled toward other programs with demonstrable need of expansion to achieve maturity. The effects of this situation are furthered by the assumption that no changes in or additions to legislation or regulations affecting the Division's activities will be made before 1982.

II. NOISE

The comprehensive stationary source noise pollution control program of Illinois is administered by the Illinois Environmental Protection Agency's Division of Noise Pollution Control. Regulations regarding vehicular noise are expected to be promulgated in 1977.

The Division is staffed by 18 persons: 11 engineers (nine are in field operations and two are in technical operations), five administrative personnel, and two attorneys. Most instances of potential violations of noise regulations are brought to the attention of IEPA personnel by private complainants. Monitoring activities in response to complaints have resulted in an extensive data file of stationary noise source information.

Although the vehicular noise regulations are expected to be promulgated in 1977 and additional regulations are being considered for blasting and drop forge operations, no increases in the Division staffing level are anticipated. Increased workload for the Division staff and the addition of noise control responsibilities to other state employees' duties (specifically state police) are planned.

Professional estimates place the number of persons in the private sector whose jobs include substantial noise control related activities at approximately 500. This workforce is expected to increase at a rate of three to five percent per year. Many positions will require considerable training in acoustics.

III. PESTICIDES

Responsibility for the control of pesticide use in Illinois is shared by the Illinois Department of Agriculture (IDA) and the Illinois Department of Public Health (IDPH), Pesticides Section. IDPH is charged with regulation of structural pest control; IDA is responsible for all other pest control categories and administration of the Federal Insecticide, Fungicide, and Rodenticide Act. The University of Illinois Cooperative Extension Service works closely with IDA in applicator training and certification.

The IDPH Pesticides Section consists of one entomologist and one biologist. They are supported by more than 100 field personnel of the Division of General Sanitation who are involved in pesticide use activities in the context of their regular duties. The IDA employs 20 persons, 14 of whom are part-time field men, in its pesticides program. The Cooperative Extension Service has 127 persons (including 98 county agents) involved in pesticides training activities and research. The IDA and Extension employees are trained as entomologists or agronomists.

No increases in public sector personnel are expected. More than 10,000 farmers have been certified in accordance with the conditions of FIFRA; the total is expected to reach 80,000 by March, 1978. Private sector certificate holders under FIFRA are expected to include 12,000 owners, operators, applicators and 625 tree experts.

IV. POTABLE WATER

Regulation and surveillance of potable water supplies is shared by the Illinois Environmental Protection Agency (IEPA) and the Illinois Department of Public Health (IDPH). Illinois has made no decision regarding primacy for the Federal Safe Drinking Water Act (SDWA). IEPA, which monitors the 1,700 minicipal water supply systems, has been designated the lead agency; but most of the estimated 11,000 sources defined as public water supplies under SDWA not now covered by Illinois law would come under the purview of IDPH.

IDPH field water supply activities are not broken out from other duties. Officials estimate eight to ten person-years are devoted to water supply. Laboratory personnel include 35 persons whose duties range from full-time to occasional water analysis work. IEPA, Division of Public Water Supplies, employs 42 persons. The Division of Laboratory Services has 24 involved in water analysis.

Projected public workforce needs are dependent upon assumption of SDWA primacy by the state. If this occurs, the workfoce may expand from the 1976 level of 96 to 155 in 1981. IDPH additions may include 20 engineers, 20 sanitarians, and 7 biologists. IEPA expects no increase.

Certified water treatment plant operators are expected to increase from the present 2,505 to 3,198 in 1981. Non-certified treatment plant personnel are expected to increase at a rate of less than five percent per year.

V. RADIATION

Two divisions of the Illinois Department of Public Health (IDPH) share monitoring and radiation source control responsibilities. The Division of Radiological Health is responsible for medical and other non-energy related uses of radiation. It monitors 7,400 medical facilities, 700 industrial facilities, and three major pharmaceutical firms. The Division of Nuclear Safety is responsible for health and safety related to nuclear energy and the uranium fuel cycle. Currently, there are seven nuclear power reactors operating at three sites, eight under construction, and two planned. There is a large uranium-hexafluoride conversion facility, a nuclear spent fuel storage facility, two nuclear related federal research installations, and a low-level nuclear solid waste disposal site.

The Division of Radiological Health consists of seven physicists and thirteen technicians (three additional positions are vacant). The Division of Nuclear Safety employs one physicist, one chemist, three engineers, and one technician. They are assisted by a chemist and a technician in laboratory services.

If Illinois does not become a Nuclear Regulatory Commission agreement state, the public sector workforce is expected to expand only slightly by 1982. One physicist, one chemist, and one engineer may be added; the three vacant technician positions are expected to be filled and one added. No projections are available which assume NRC agreement status.

VI. SOLID WASTE

The Division of Land Pollution Control of the Illinois Environmental Protection Agency (IEPA) is charged with solid waste pollution control in Illinois. There are 465 solid waste disposal sites; slightly more than one-half are defined as municipal or general and the remainder are demolition sites. The IEPA estimates that more than 60 percent of the solid waste in Illinois is generated in the six-county Chicago metropolitan area.

Resource recovery activities include the recently completed City of Chicago/Commonwealth Edison Refuse Derived Fuel (RDF) power generation plant, which operates on fuel consisting of 90 percent coal and ten percent solid waste. A similar but smaller plant is planned for Springfield.

The safe disposal of hazardous materials and liquid wastes is considered of primary concern to IEPA and the relatively few firms which handle them.

The IEPA Division of Land Pollution Control is staffed by seven engineers, four biologists, nine geologists, two sanitarians, two attorneys, seven technicians, and five clerical persons. The Division expects to add one engineer, a technician and three positions classified as "other" by 1982.

The private sector workforce is expected to increase from the present estimated 12,295 engaged in collection, disposal and resource recovery to 16,476 in 1981. Should resource recovery activities accelerate, the increase may be substantially greater.

VII. WASTEWATER

The wastewater program in Illinois is under the direction of the Division of Water Pollution Control, Illinois Environmental Protection Agency (IEPA). Illinois is not actively seeking National Pollution Discharge Elimination System (NPDES) authority.

The Division of Water Pollution Control is staffed by 196 persons. Seventy-six are engineers; 18 are classified as resource planners, with a minimum of a four-year degree in resource or urban planning; 27 are environmental protection specialists (degreed in the natural sciences or chemistry); nine are attorneys; 13 are environmental technicians, who have at least a high school education and extensive on-the-job training; six are aquatic biologists; the remainder are administrators, accountants, and clerical persons. Although Division personnel anticipate a need for additional positions to deal with future program development, no increase is expected through 1981.

Certified wastewater treatment plant operators now total 2,201 and are expected to total 3,385 in 1981. Certified personnel are estimated to comprise less than 25 percent of the total private sector workforce. This percentage is expected to increase as IEPA continues its efforts in training and certification of operators.

VIII. ENERGY

Responsibilities for energy related matters are scattered throughout the governmental structure of Illinois. Several plans for reorganization, with the emphasis upon consolidation of energy responsibilities, have been proposed. Acceptance of any of the proposals is unlikely at this time.

There are two entities whose primary responsibilities are energy related. The Division of Energy (DOE) is currently a unit of the Department of Business and Economic Development. DOE began as the Office of the Fuel and Energy Coordinator; its responsitilities were expanded by the governor when it was given divisional status. DOE activities are hampered because of a lack of any legislated mandate. Staffing is fluid. Currently, three persons are involved in fuel allocation, two in coal development, three in program development, and twelve (four of them contractual) in energy conservation and alternative energy sources.

The Illinois Energy Resources Commission (IERC) is a legislative commission comprised of eight legislative and ten public members. The permanent staff of three has been temporarily expanded to eleven. The temporary staff is involved in drafting energy legislation and developing government reorganization plans.

No estimates of the present private sector energy pollution control and abatement workforce or projections for the future are available for this nebulous area.

STATE OF ILLINOIS - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR[1]	130	132	136	139	142	144	2%
NOISE[2]	18	18	18	18	18	18	0%
PESTICIDES[3]	257	257	257	257	257	257	0%
POTABLE WATER[4]	96	96	124	155	155	155	N/A
RADIATION[5]	32	32	35	37	38	40	5%
SOLID WASTE[6]	36	37	38	39	40	41	3%
WASTEWATER[7]	196	196	196	196	196	196	0%
ENERGY[8]	--	--	--	--	--	--	N/A
TOTALS	729	786	804	841	846	851	3%

[1] The above represents only state program personnel.

[2] The above does not include private sector, for which no figures were available.

[3] The above does not include 750 state transportation and local personnel, 80,000 farmers, 12,000 private applicators, or 625 tree experts who will be certified.

[4] The above does not include the estimated 693 water treatment plant operators who will be certified over the next five years. SDWA primacy by the state is assumed.

[5] The above includes only state agency personnel.

[6] The above does not include the private sector personnel, estimated to increase by 4,181 over the next five years.

[7] The above does not include the estimated increase of 1,184 (9% per annum growth) for certified operators over the next five years.

[8] The energy workforce situation is too fluid for projections to be made.

EDUCATION

Illinois has an extensive array of environmental/energy programs at the post-secondary level. In 1974-75, the Illinois Institute for Environmental Quality and the Illinois Board of Higher Education pooled resources to develop a "Master Plan for Environmental/Energy Higher Education in Illinois". The U.S. Environmental Protection Agency joined in the effort and provided funds which enlarged the scope of the project. In May, 1975, the results of the project were published under the title, "A Work Force for Environment and Energy." The book includes the following types of information concerning environmental/energy post-secondary education in Illinois:

1) Detailed descriptions of ongoing environmental and energy programs at state universities in Illinois;
2) Descriptions of proposed environmental and energy programs at state universities in Illinois;
3) Recommendations for Illinois Board of Higher Education approval of proposed environmental and energy programs;
4) Brief descriptions of environmental and energy educational programs offered in private universities and colleges in Illinois;
5) Synopses of programs and course offerings at Illinois community colleges;
6) Recommendation for initiating and implementing environmental/energy operating plans for the campus of each public university and college in Illinois;
7) Recommendation for establishing Environmental Resource Centers at community colleges;
8) Suggested curricula for Illinois community college degree and certificate programs;
9) Manpower study of pollution control fields in Illinois;
10) A variety of recommendations and reference materials to enhance cooperation among institutions of higher education in Illinois in environmental and every related matters.

LEGISLATION

The environmental/energy legislation for Illinois was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Environmental Protection Act

Custom Application of Pesticides Law

Pesticide Use in Illinois

Water Supply Operator Certification Law

Radiation Installation Registration Law

Radiation Monitoring Act

Radiation Protection Act

Surface-Mined Land Conservation and Reclamation Act of 1971

National Environmental Energy Workforce Assessment

Phase I

ILLINOIS

State Report

STATE PROFILE

The State of Illinois, encompassing 56,400 square miles, became the twenty-first to be added to the union, in 1818. The 11,250,000 residents comprise approximately 5% of the nation's population and are 80% urban. Illinois is sharply divided culturally and politically between the six-county Chicago metropolitan area of seven million people and "Downstate" which refers to all of Illinois but the northeast corner.

Illinois stretches 400 miles from the Wisconsin border to the confluence of the Mississippi and Ohio Rivers. Economically and, to some degree geographically, the state can be viewed to have three regions. In the north a highly industrialized band extends from Chicago on the shore of Lake Michigan to the Rock Island-Moline area on the Mississippi River. The industrial areas are interspersed with rich farmland. The central portion of the state includes several middle-sized cities whose economic bases are agriculture, manufacturing, education, food processing, and services. Among them are Springfield, the capital, Decatur, Champaign-Urbana, and Peoria. The land is deep, rich black earth of glacial origin underlain with extensive coal deposits. To the south, beyond the extent of glaciation, lies less fertile, forested Ozark-like hill land. The area is characterized by more southern rural atmosphere and attitudes. This "Little Egypt" region lies further south than Richmond, Virginia. Coal mining is a major component of the economy.

Illinois' diversified economy, combining healthy elements of manufacturing, agriculture (including processing) coal mining, transportation, finance and services can be considered as a microcosm of the nation.

Illinois leads the states in foreign exports, much of this due to its number one position in non-electrical machinery manufacturing, fabricated metals, and output of soybeans. It annually vies with Iowa for first place in corn production and is second in pork production, food processing and the printing and publishing industries. It ranks third in electrical machinery manufacture and is highly ranked in beef production. Illinois contains the largest bituminous coal reserves in the country and is the recognized leader in nuclear electrical power generation.

Chicago is the second largest city in the United States. It is the nation's rail center; O'Hare International Airport is the busiest in the world. With the completion of the St. Lawrence Seaway, Chicago has become a seaport with access through Lake Michigan. It is the hub of the interstate highway system and is a terminal for barge traffic on the Illinois and Mississippi Rivers.

The prosperous economic activity and Illinois' keystone position in transportation have taken their toll in environmental quality. Air pollution is a serious problem in the industrial cities. Use of high-sulfur Illinois coal for power generation has been curtailed due to air pollution control standards. The 500 streams which drain Illinois have suffered extensive contamination from industrial and agri-business discharges. Wastewater treatment facilities are hard pressed to keep pace with the demands of the expanding urban and industrial society. Water supply may become a significant problem of the future as, even now, 53,000,000 gallons are used in Illinois daily and water tables are dropping rapidly. The volume of solid waste and the increasing amounts of hazardous materials are posing disposal difficulties of considerable extent. The major proportions of the multi-faceted Illinois nuclear industry pose problems peculiar to that field; the industry is growing and the volume of radioactive materials transported in the state is unparalleled. The people of Illinois are beginning to show increased awareness of noise pollution and are taking steps to alleviate it. Illinois is a high energy user; energy conservation and conversion activities are taking on belated significance. The loss of prime agricultural land to strip mining operations, road systems, and urban sprawl has become a matter of major concern to agricultural interests.

The official state song, "Illinois", expresses in a few lines of poetry what many volumes of prose have attempted:

"Illinois"

By thy rivers gently flowing, Illinois, Illinois,
O'er thy prairies verdant growing, Illinois, Illinois,
Comes an echo on the breeze,
Rustling through the leafy trees, and its mellow tones are these,
Illinois, Illinois,
And its mellow tones are these, Illinois.

From a wilderness of prairies, Illinois, Illinois,
Straight thy way and never varies, Illinois, Illinois,
Till upon the inland sea,
Stands thy great commercial tree, turning all the world to thee,
Illinois, Illinois,
Turning all the world to thee, Illinois.

Not without thy wondrous story, Illinois, Illinois,
Can be writ the nation's glory, Illinois, Illinois,
On the record of thy years,
Abraham Lincoln's name appears, Grant and Logan, and our tears,
Illinois, Illinois,
Grant and Logan, and our tears, Illinois.

ILLINOIS POLLUTION CONTROL AND ABATEMENT AGENCIES

The Illinois Environmental Protection Agency (IEPA) is the principal state environmental agency under provisions of the Illinois Environmental Protection Act of 1970. Three entities were established under the Act. The Pollution Control Board is a quasi-judicial body which issues regulations and hears cases of violations; the Institute for Environmental Quality is responsible for issuing environmental research grants; the Environmental Protection Agency is responsible for issuance of permits, monitoring activities, and enforcement of pollution standards and regulations.

IEPA is responsible for air, noise, potable water, solid waste, and wastewater programs. The Environmental Programs are organized into seven divisions. Three are support divisions: Data Processing, Enforcement Services, and Laboratory Services. The program divisions are: Air Pollution Control, Land/Noise Pollution Control (includes solid waste and noise programs), Public Water Supplies (potable water), and Water Pollution Control (wastewater).

IEPA has been designated the lead agency for enforcement responsibility of the Safe Drinking Water Act and the National Pollution Discharge Elimination System, should the state accept primacy.

The Illinois Department of Public Health (IDPH) also has legislated responsibilities for pollution control and abatement activities. The Office of Consumer Health Protection has responsibilities for non-municipal public water supplies at facilities not specifically designated the responsibility of IEPA. Most public water supplies so designated by the federal Safe Drinking Water Act which are not dealt with as public water supplies under Illinois law would come under the jurisdiction of IDPH if Illinois accepts primacy.

Radiation control activities are the purview of two IDPH divisions. The Division of Radiological Health is responsible for medical and other non-energy related uses of radiation; the Division of Nuclear Safety is responsible for health and safety related to nuclear energy and the uranium fuel cycle (including a hazardous waste disposal site). The workload of the Division of Nuclear Safety will expand markedly as eight new reactors are scheduled to come on line in the 1980's. Current staffing for the two IDPH divisions is 32.

The Illinois Department of Public Health and the Illinois Department of Agriculture (IDA) share responsiblity for the pesticides control program in the state. IDA is the lead agency for administering the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Both departments are involved in training and certifying pesticides applicators. The University of Illinois Cooperative Extension Service works closely with IDA in training efforts. IDPH has a two person pesticides staff which has the support of more than a hundred field people; IDA employs 20 persons in pesticides training and certification; the Cooperative Extension employs 127 persons in pesticide training and research.

Energy planning and development in Illinois is decentralized. Plans for reorganization of responsibilities are currently being considered. Presently major responsiblity for energy matters is vested in the Department of Business and Economic Development's Division of Energy which began as the Office of the Fuel and Energy Coordinator. Current staffing level is 27. The Illinois Energy Resources Commission is a legialative commission with a temporary staffing level of 11. The Commission has developed several alternative plans for state government energy reorganization and is responsible for approval of expenditures of $70 million in bond money for coal development.

Pollution Control and Abatement Programs

I. AIR

A. Introduction

The Air Pollution Control Division of the Illinois Environmental Protection Agency (IEPA) has primary responsibility for air pollution control in Illinois. IEPA monitoring efforts are assisted by many local agencies and volunteers who take readings at the sampling sites.

Changes in operations and emphasis of the Air Pollution Control Division (APCD) since the 1974 Illinois report include less emphasis upon enforcement and increasing emphasis on air quality analysis, planning, and maintenance activities. Voluntary compliance is also receiving greater emphasis. The total staffing has increased from 124 to 130.

The Air Pollution Control Division is made up of two branches: compliance and air quality. The Compliance Branch includes two sections: field operations and permits. The Air Quality Branch has three sections: episodes, ambient air, and air resource.

IEPA's mandate covers stationary sources and vehicular emissions. IEPA has issued 23,000 permits which cover operations at 19,000 facilities. Approximately 400 permits a month are being processed. These breakdown to:

1) 100 permits for newly constructed sources and pollution control equipment installations;

2) 100 permits for installation or replacement of pollution control equipment in existing facilities;

3) 150 operating permits for existing sources;

4) 50 renewal operating permits for existing sources.

Permits are issued for five years or less; most are good for only two years. Approximately 50% of all permits issued by IEPA are for facilities in seven counties in the northeastern part of the state (the Chicago metropolitan area). Of the remaining 50% of all permits, 20% are issued in the East St. Louis area; 20% to Decatur; 20% to Peoria; 20% to the Quad Cities area; and the remaining 20% throughout the state.

The ambient air section coordinates and/or maintains a statewide network of more than 300 air monitoring sensing devices at about 100 locations. Fifteen telemetry sites are tied directly to Springfield by computer.

Illinois air quality has shown improvement over the past few years. There are still major problems with SO_2 emissions and particulate matter. Some problems are due to industries in violation of the law; some (especially problems involving particulates) are due to meteorological circumstances such as dry conditions and high winds combined with agricultural cultivation practices. East St. Louis and the Chicago metropolitan area have exceeded acceptable ozone levels several times in the past year. Yellow alerts (requests for voluntary action to alleviate the problem) were issued five times.

B. Workforce Profile

Information for this and other sections was obtained during on-site interviews and follow-up telephone calls. Ms. Dorothy Dumbrowski, Dr. Robert Arnott, Mr. Ed Cave and Mr. David Kolaz were particularly helpful.

Table I presents the 1976 staffing level of the Air Pollution Control Division of the Illinois Environmental Protection Agency.

TABLE I

IEPA AIR POLLUTION CONTROL DIVISION

Current (1976) Staffing Level

Position	1976
Engineer	55
Meteorologist & Scientist	18
Attorney	6
Technician	20
Other	31
TOTAL	130

Thirteen of the above persons are employed at two air monitoring units and their support facilities located in Springfield and Chicago. The engineers include chemical, civil, and mechanical engineers and are classified as Environmental Protection Engineers. The number of engineers has been reduced from 69 in 1974, to the present 55. This change was offset by an increase in the meteorologist and technician category. APCD personnel feel their salaries compare favorably with their counterparts in other states, but not well with positions in industry which require comparable education and experience.

No estimates were available as to the number of persons involved in air pollution control in the private sector in Illinois. People were unwilling to provide any semblence of an approximation. Engineers and management personnel responsible for air pollution control for an industrial facility often have duties which are not restricted to air pollution control; thus, their job titles do not necessarily reflect involvement in air pollution control although such tasks and responsibilities may require a substantial portion of their time. "Several thousand" is as close as anyone would come to an estimate of the number of persons working part or full-time in air pollution control in Illinois industries. Engineers and technicians are thought to dominate the field overwhelmingly.

C. Workforce Projections

The freeze on state agency positions affects the APCD. The ambient air section will hire two engineers in 1977 to be paid with federal funds.

Table II presents the projected change in IEPA Air Pollution Control Division staffing through 1981.

TABLE II

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Air Pollution Control Division
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	55	57	58	58	58	58	N/A	N/A
Meteorologist & Scientist	18	18	18	20	22	22	N/A	N/A
Attorney	6	6	6	6	6	6	N/A	N/A
Technician	20	20	22	23	24	25	N/A	N/A
Other	31	31	32	32	32	33	N/A	N/A
TOTAL	130	132	136	139	142	144	N/A	2%

The Air Pollution Control Division is a relatively mature program compared to other pollution control areas. The slight increases in the workforce projections through 1981 reflect assumed increase in workload, monitoring and field activities.

As no data are available regarding the private sector workforce, no projections are possible. Sources, however, do agree that industry will continue to contract with air pollution control consultants and to hire personnel (most frequently engineers) to deal with air pollution control problems. Well qualified persons will be sought by private consultant firms.

D. Training and Certification

Air Pollution Control Division personnel attend semi-annual smoke reader training school sessions. These sessions are in-house programs; approximately 50 persons attend annually. APCD personnel also attend EPA short courses in air pollution control practices, when available. On-the-job training and experience are considered extremely important to APCD administrators. Technician training (especially in community college programs) is well thought of, although often too specific on content. IEPA Division people feel they would rather depend upon on-the-job training to round out the competencies of technician personnel than to have community college training broadened. Conversely, education of professional level personnel is often thought to be too broad and not specific enough to air pollution problems. Again, on-the-job experience is considered the best remedy.

E. Career Potential

Career potential in both the public and private sectors is limited. Growth in the public sector is subject to economic conditions. As the air pollution control program is a relatively mature one, justification for expansion in this area is more difficult than for other programs which are still in the formative stages and in demonstrable need of greater emphasis. The need for additional technicians and engineers in industry will be dependent upon enforcement of existing laws and regulations and passage and implementation of new measures. Industry is not likely to expand capital for air pollution control unless it is mandatory. Opportunities for highly trained, capable individuals will exist, especially with consultant firms.

F. Conclusion

The air pollution control field will continue to be dominated by persons with training in engineering, meteorology, and other sciences. Technicans with skills in mechanics and electronics will continue to be needed. However, few opportunities will present themselves in the public sector due to limited funding and mature program status. Private sector workforce needs in air pollution control are not likely to increase substantially unless more stringent air pollution standards are enacted and enforced. Careers in air pollution control will be severly limited in the next few years unless there is a change in legislation and/or regulation. Opportunities will exist for well qualified people in private consulting firms.

STATE OF ILLINOIS

AIR QUALITY ORGANIZATIONAL CHART

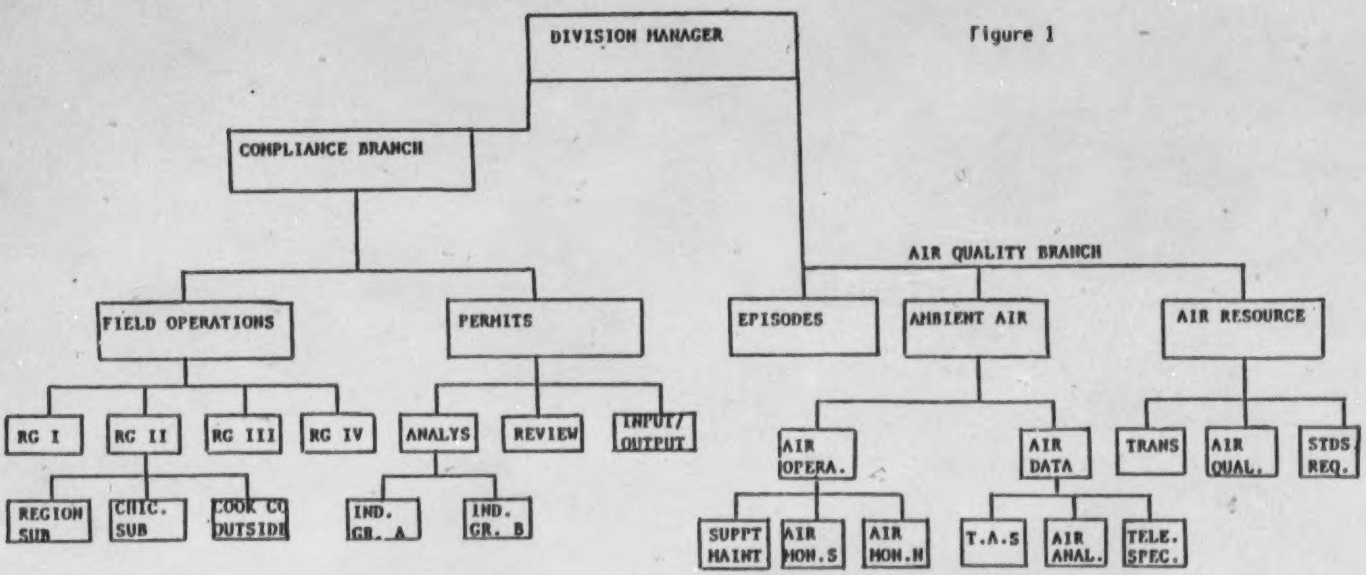

DIVISION MANAGER
COMPLIANCE BRANCH
FIELD OPERATIONS
PERMITS
RG I
RG II
RG III
RG IV
REGION SUB
CHIC. SUB
COOK CO OUTSID
ANALYS
REVIEW
INPUT/ OUTPUT
IND. GR. A
IND. GR. B
AIR QUALITY BRANCH
EPISODES
AMBIENT AIR
AIR RESOURCE
AIR OPERA.
AIR DATA
SUPPT MAINT
AIR MON.S
AIR MON.N
T.A.S
AIR ANAL.
TELE. SPEC.
TRANS
AIR QUAL.
STDS. REQ.

Figure 1

II. NOISE

A. Introduction

Illinois has been a leading state with regard to noise pollution control since the passage of the 1970 Illinois Environmental Protection Act, which empowered the Pollution Control Board (PCB) to adopt regulations establishing limitations for stationary noise sources. The subsequently adopted regulations are the most comprehensive of their kind in the nation. They include sound emission standards and limitations dependent upon classifications of actual land use (not just zoned use). The limitations are further delineated as to octave band; i.e., the noise level (measured in decibels) allowed is lower in higher octave bands than in lower bands. The regulations, which also specify prescribed measuring techniques, are being enforced.

Since the original report concerning noise control activities in Illinois, the Illinois Environmental Protection Agency (IEPA) has maintained its position as a leader in noise control in enforcement activities, data collection, and the development of new regulations. These activities are discussed more fully below.

Most instances of potential violations of Illinois noise regulations are brought to the attention of IEPA by private complainants. The complaints are investigated and the source is measured. If a violation is indicated, the appropriate data are made available to the owner or operator of the facility and efforts are made to establish a mutually acceptable plan for bringing about compliance with the regulations. Grain elevators have been the most frequent focus of complaints. The bulk of the problems have been resolved subsequent to compliance conferences. Only ten to fifteen percent of the cases have had to be taken before the Pollution Control Board; of these, IEPA has not lost a case nor an appeal.

IEPA monitoring activities in response to complaints and at the requests of owners of stationary noise sources have led to the accumulation and compilation of what is perhaps the most extensive collection of data on stationary noise sources available. IEPA property line noise level data are collected for a broad variety of noise types (air conditioners and industrial cooling units, grain dryers, and blasting are examples).

The comprehensiveness of the regulations and the collected data and the success of enforcement have led several states to consult with IEPA personnel as they work to develop similar regulations for stationary noise sources.

The Illinois Environmental Protection Act also empowered the PCB to adopt regulations regarding motor vehicle noise. Regulations were adopted May 12, 1977.

Significant research, federally and/or industry funded, has been conducted into the more intricate aspects of noise resultant from mining and quarrying blasting and drop forge operations. IEPA expects regulations for these noise sources to be developed when relevant data are available. Hearings are now being held in both the blasting and forging issues; proposals for regulations have been made for the latter.

Regulations limiting airport noise levels may be the next to be considered.

Cities have shown increased interest in noise control and many have updated noise ordinances. A recent Illinois Supreme Court decision is expected to have a marked effect on the enforcement of these and older noise ordinances. The Court ruled in favor of the defendant (Chicago and Northwestern Railroad) in a suit brought against it by the City of Des Plaines for violation of city noise ordinances. The basis for the decision was that the scope of the operations of the railroad is greater than the jurisdiction of the city; thus, the legality of city noise ordinances' applicability to an operation such as the railroad is challenged. Whether this will cause cities to adopt ordinances based on state regulations or to leave noise control to the state to enforce is yet to be seen.

B. Workforce Profile

Mr. James Reid, manager of Field Operations for the Division of Noise Pollution Control, IEPA, was especially helpful with this section and other aspects of noise control.

IEPA has sixteen professionals working in noise control. Of these, twelve are engineers/scientists, two are attorneys, and two are administrators. Nine of the engineers are in field operations; four are based in Chicago and five (including the manager) are in Springfield. The three engineers/scientists in the technical operations section are responsible for development of regulations and for dealing with variance requests. Staffing level has been and is expected to remain constant for some time.

Table III presents the breakdown of professionals employed in the Illinois Environmental Protection Agency's Division of Noise Pollution Control. Clerical personnel are now assigned to the word processing section.

TABLE III

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Division of Noise Pollution Control
Current (1976) Staffing Level

Position	1976
Engineer/Scientist	12
Administrator	2
Attorney	2
TOTAL	16

Industry employment figures are difficult to assess as noise problems are frequently only part of an individual's responsibilities. It is estimated that at least 300 people are involved in environmental and occupational noise control in Illinois industry.

There are more than twenty consultant firms in Illinois which deal with noise problems. Many are one or two-person operations with support staff. Most are engineers who specialize in a particular type of noise source problem such as architectural, industrial, etc. The number of manufacturers and suppliers of acoustical equipment has been increasing due to increased demand.

In all, approximately 500 people are estimated to hold jobs in which noise control-related activities form a significant portion of their work load. The great majority are engineers and/or physicists.

C. Workforce Projections

The public sector of the noise pollution control workforce is not expected to increase in the near future. IEPA would like to open a regional field office in Rockford, but this seems unlikely at this time.

Some state employees may have noise control added to their duties or will play an increasing role over the present level. Among these will be state policemen who will operate in two-man teams. They will be trained to monitor motor vehicle noise and be empowered to stop and issue citations to violators now that the Pollution Control Board regulations for motor vehicle emissions have been adopted.

Acoustical research activity is increasing. Much of it is industry initiated and funded. Engineers and technicians with acoustical training will be in increasing demand as noise problems become of greater concern and legislation and regulations become more encompassing.

Professionals agree that applicants for jobs requiring knowledge of acoustics are better qualified now than in the past. Most believe there are more openings than people with the best qualifications to fill them.

The workforce in noise pollution control is expected to increase and to do so in a variety of position classifications, most of which will require considerable training and experience in acoustics. A growth rate of three to five percent is a reasonable estimate.

D. Training and Certification

The University of Illinois, Southern Illinois-Edwardsville, Northern Illinois and Sangamon State University offer course work and conduct research in acoustics. Some training is accomplished by consultant firms which are called in by public and private agencies to conduct in-house training sessions in methodology and monitoring, but such training is not carried out on a regular basis. A four-year or advanced degree in engineering, physics, acoustics or a related scientific discipline is the primary requisite for entering the field.

IEPA has had summer internships for Sangamon State students. Two students have been assigned to work in the Division of Noise Control. The Agency and the Division have been pleased with the program.

The Agency has supported continuing education opportunities for personnel, both in technical and managerial aspects of noise pollution control.

IEPA has no plans for certification of consultants or others working in noise control.

E. Career Potential

Highly trained individuals will be sought for positions in research, teaching, and industry. Any increase in the public sector will be dependent upon monies available for positions; at present, such positions are subject to a job freeze in Illinois.

If public awareness continues to increase, more people will be needed in enforcement and at the technician level for monitoring noise sources. There is no possibility of predicting such an increase under the present budgetary conditions.

F. Conclusion

Although noise pollution control is a relatively recent development, it is an expanding area in Illinois. The field is staffed by extensively trained and experienced people specializing in scientific areas.

Subsequent to the previous Illinois study, IEPA has made significant strides in the areas of enforcement of existing legislation and regulations, development of new regulations covering additional noise sources, and collection and compilation of noise source data.

As previously indicated, further regulation and increased public awareness will result in a continued need for specialists and for program development leading to more careers in technical areas which do not require a four-year degree.

An annual growth rate of three to five percent is expected in employment in private sector noise pollution control in Illinois.

III. PESTICIDES

A. Introduction

The Illinois Department of Agriculture (IDA) is the lead agency for certification of pesticide applicators in Illinois. In addition to its role in administration of state agricultural legislation, it has the major responsibility to ensure Illinois' compliance with the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) which will require certification of all commercial and private pesticide applicators who use restricted pesticides when it becomes effective (October, 1977).

Preparations for compliance with FIFRA have resulted in significant changes in pesticides control in Illinois since the original study. The Division of Sanitation, Illinois Department of Public Health (IDPH) now has responsibility for regulation of structural pest control under the Illinois Structural Pest Control Act, which became effective October 1, 1975. The Act is currently being amended to bring the state law in compliance with FIFRA. IDPH will continue to be responsible for structural pest control activities and IDA will be responsible for all other pest control categories under the conditions set forth in the Illinois State Plan developed by the Illinois Department of Agriculture to bring the state into compliance with FIFRA. The state plan is now being reviewed at the federal level.

The University of Illinois Cooperative Extension Service works closely with the Illinois Department of Agriculture in efforts to train and certify applicators.

Data regarding the pesticide related workforce in Illinois remain largely unavailable as was indicated in the previous Illinois report. The reasons are the same. Commercial pesticide operations adamantly refuse to divulge employment data for fear the information will compromise their position with their competitors. This reticence has been responsible for no data collected dealing with the hundreds of commercial pesticide operations in the state. These include companies engaged in pest control which are one-man operations and those large corporations employing dozens.

B. Workforce Profile

The Illinois Department of Agriculture employs 15 part-time field men designated as plant and pesticide specialists. Most have four-year degrees in agronomy or entomology. Their chief function is to report violations, analyze conditions and to assist and/or conduct seminars for applicator/operator licensing.

The Cooperative Extension Service employs four people designated as area staff, approximately 25 as state staff (based in Urbana) whose primary activities are pesticide related, and 98 county agents (extension advisors). These are, for the most part, agronomists and/or entomologists.

The Illinois Department of Public Health has two people assigned specifically to pesticide control. One is an entomologist; the other, a biologist designed as program administrator. There are more than a hundred people in the Division of General Sanitation working as health technicians, environmental and health inspectors, environmental control engineers and environmental health sanitarians, who are involved in pesticide use and pest control practices to varying degrees in the context of their general duties. The duties of IDPH personnel (especially those in the field) are varied and multi-faceted. There is no reporting procedure which lends itself to breaking out time allocations for specific tasks. Although IDPH field personnel do have some pesticide-related responsibilities, department spokesmen felt it would be misleading to count them among the public sector pesticide workforce.

There are approximately 123,000 farmers in the state. It is not known what portion of these apply their own pesticides. However, it is estimated that 80,000 may be certified to handle restricted pesticides by March, 1978. The number presently certified is 39,000 or slightly more.

In addition, there are 625 active licensed tree experts who deal with pesticides. Presently, these people are licensed by the Illinois Department of Registration and Education. These licensees are expected to be subject to the Illinois Department of Agriculture regulation within the next year.

The public sector includes some three to four hundred county and state employees who are engaged in right-of-way pest control and probably an equal number of municipal or village employees whose duties involve pesticide application.

The total estimated pest control picture is reflected by the following table in which figures are approximations of the workforce engaged in pesticides on either a full- or part-time basis.

TABLE IV

STATE OF ILLINOIS

Pesticide Workforce in Public and Private Sectors
Current (1976) Staffing Level (est.)

	1976
Public Sector	
Department of Agriculture	20
Cooperative Extension	127
Department of Public Health	2
Department of Transportation, Counties, etc.	350
Municipalities, Villages, etc.	400
TOTAL	899
Private Sector	
Farmers	123,000
Tree Experts	625
Owners/Operators/Applicators	12,000
TOTAL	135,625

C. Workforce Projections

Workforce projections for pesticides in Illinois are essentially unobtainable; some data are wholly absent, others are conflicting.

Turnover in the public sector is essentially nil (under five percent per year). Turnover in the private sector is estimated at thirty to forty percent per year. This high rate is attributed to low wages, little opportunity for advancement and health concerns. Both public and private sectors are not expected to increase significantly, although those certified will increase due to the requirements of FIFRA. The public sector is now operating under a job freeze. This has a particularly harsh effect in IDPH where only two people must handle the certification and training and deal with violations of state laws.

D. Training and Certification

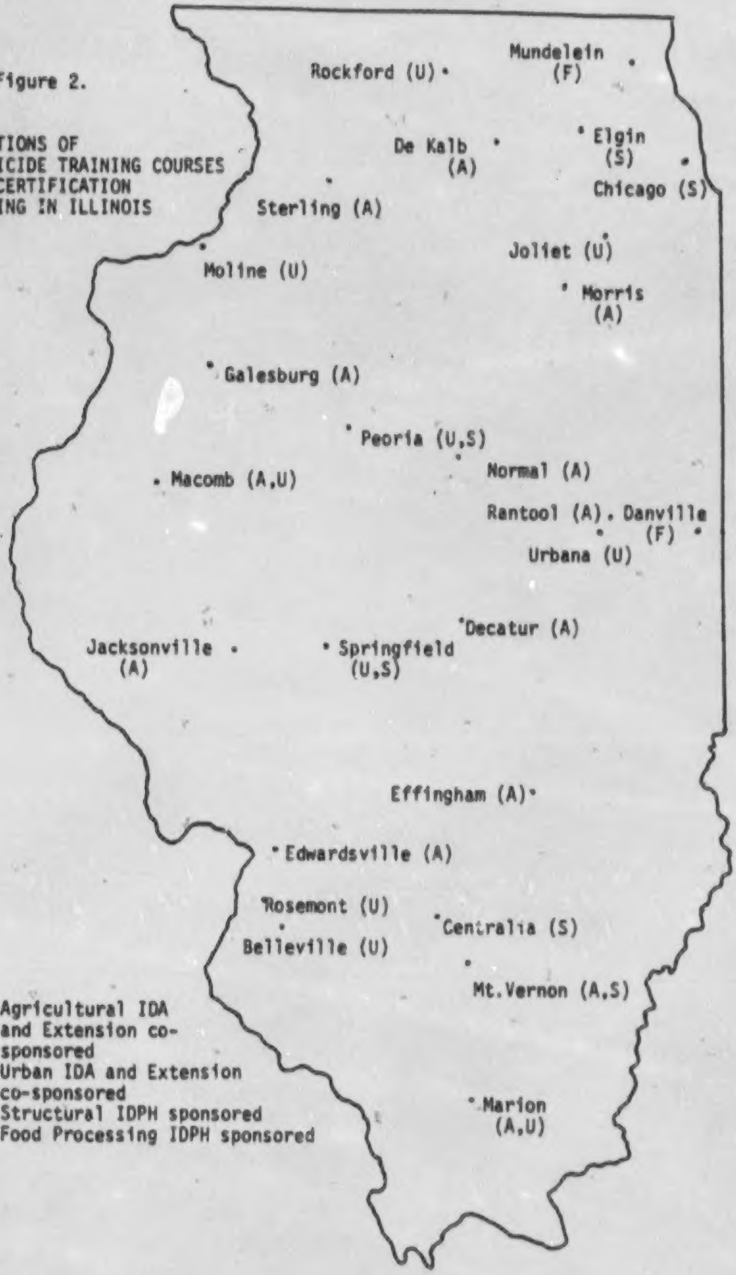
The Cooperative Extension Service annually conducts 25 regional one-day training sessions for private pesticide applicators (primarily for farmers), a three-day conference for commercial applicators, and a four-day workshop in pest management geared for commercial operations. These sessions provide training leading to certification. The 98 county agents conduct half-day sessions for farmers. The sessions are scheduled upon demand. Each of the 98 counties held at least two sessions last year; some counties held as many as seven.

The Department of Agriculture and Cooperative Extension Service co-sponsor training sessions in commercial pesticide use and control held in several locations throughout the state which provide the recipient with the information necessary to obtain a custom applicator/operator's license. In the past year, thirteen sessions were conducted for training in agricultural pesticide use practices and ten for urban pest control. Figure 2 indicates the locations.

The Illinois Department of Public Health has offered ten training courses and examination sessions in the past year. Six were for general structural certificates , two for food processing and two for manufacturing. The locations for these sessions are also indicated on Figure 2.

Figure 2.

LOCATIONS OF PESTICIDE TRAINING COURSES AND CERTIFICATION TESTING IN ILLINOIS


Rockford (U)
Mundelein (F)
De Kalb (A)
Elgin (S)
Chicago (S)
Sterling (A)
Moline (U)
Joliet (U)
Morris (A)
Galesburg (A)
Peoria (U,S)
Normal (A)
Macomb (A,U)
Rantool (A)
Danville (F)
Urbana (U)
Decatur (A)
Jacksonville (A)
Springfield (U,S)
Effingham (A)
Edwardsville (A)
Rosemont (U)
Centralia (S)
Belleville (U)
Mt.Vernon (A,S)
Marion (A,U)

(A) Agricultural IDA and Extension co-sponsored
(U) Urban IDA and Extension co-sponsored
(S) Structural IDPH sponsored
(F) Food Processing IDPH sponsored

TABLE V

STATE OF ILLINOIS

Persons Attending Pesticides Training Sessions in Illinois, 1976

	Type of Training	Attendants
Cooperative Extension		
25 Regional Sessions (1-day)	Farmer	5,000
1 Conference (3-day)	Commercial	1,705
1 Workshop (4-day)	Commercial	150
County Sessions (half-day)	Farmer	12,000
Department of Agriculture		
23 Sessions (1-day) Urban and Agriculture	Commercial	7,500
Department of Public Health		
8 Sessions (1-day)	Commercial	1,200
2 Sessions (4-day)	Food Processing & Mfg. Pest Control	400
	TOTAL	27,955

At the present, a state license may be issued by the Illinois Department of Agriculture for one or all of the following five pest control areas: 1) Field Crops; 2) Ornamental and Turf; 3) Aquatic; 4) Right-of-Way; 5) Mosquito. The Illinois Department of Public Health issues licenses for structural pest control operators. Private companies may and do run their own training programs, although the trainees must still take the IDA or IDPH examination to acquire the appropriate certificate.

IDA established a five-year limit which necessitates retesting individuals upon expiration of their certificate(s).

Department of Public Health certificates are valid for three years and are renewable upon the completion of a re-training course. Business locations are licensed for one year if three conditions (as specified in the Illinois Structural Pest Control Act) are met: 1) the company carries the required amount of insurance; 2) application is made with the proper fees ($50.00 per year); 3) a minimum of one employee is a certified pesticides technician. Four hundred twenty-seven companies have applied (ten percent whose offices are out-of-state); 350 have been granted licenses.

TABLE VI
STATE OF ILLINOIS
Pesticide Certification in Illinois

	1974	1975	1976
Department of Agriculture			
Commercial Applicator	1,878	1,732	2,220
Commercial Operator	2,355	2,744	3,266
Public Applicator	1,097	1,316	1,618
Public Operator	1,237	1,328	1,448
TOTAL	6,603	7,120	8,552
Department of Public Health			
Commercial (structural)	N/A	N/A	623
Commercial (food processing)	N/A	N/A	218
TOTAL			841

As the federal guidelines are enforced, Illinois expects to train and examine individuals in an additional eight areas: 1) Demonstration and Research (Extension Personnel, Vocational Agriculture, Chemical Company Representatives); 2) Regulatory (Federal, State, County, Township, Municipal); 3) Public Health (Federal, State, County, Township, Municipal); 4) Livestock; 5) Forest; 6) Seed Treatment; 7) Structural, Industrial, Institutional, and Public Health (now partially covered by IDPH certification; 8) Grain facility.

Although there are several universities and community colleges which offer coursework in pesticides, usually as a portion of a sequence such as turf management, there are no formal post-secondary programs leading to specific degrees in pest control in Illinois. The increased regulation and enforcement resulting from the implementation of FIFRA are expected to lead to the development and implementation of formal training programs by universities, community colleges and vocational technical training centers. Department of Public Health personnel are particularly concerned that post-secondary programs be initiated, but have not yet discussed the matter formally with any institution.

E. Career Potential

Jobs on applicator crews are continually available due to the high turnover rate. The previously discussed reasons for the high turnover rate also have a negative effect for this area as a career choice. FIFRA will undoubtedly have an impact with regard to jobs requiring individuals with two or more years of college training after 1979, especially in integrated pest management. Integrated pest management has not made significant inroads into Illinois pest control activities as yet.

IV. POTABLE WATER

A. Introduction

Responsibility for regulation and surveillance of potable water supplies in Illinois is divided between the Illinois Environmental Protection Agency (IEPA), Division of Public Water Supplies, and the Illinois Department of Public Health (IDPH). IEPA monitors the 1,663 municipal systems; other systems which provide water to at least ten separate lots or properties; state-owned parks and memorials; and state-owned educational, charitable, or penal institutions. IDPH monitors all other potable supplies, which could include as many as 11,000 non-community public water supplies. County health departments are now involved in efforts to determine a more accurate count. It is estimated that there are a total of 12,600 to 13,000 public water supply sources in the state.

Illinois residents obtain potable water from three types of sources: 1) deep aquifers (wells may be sunk to depths of 1,500 feet); 2) drift wells ranging from a few to 500 feet deep to tap into water moving through sand and gravel deposited by glacial movements; and 3) surface supplies (streams, rivers, lakes and reservoirs). Generally, deep wells predominate in the north; surface supplies become increasingly common toward the southern half of the state. Only about ten percent or less are surface sources.

Water treatment facilities and distribution systems are classified according to the types of treatment conducted. The four classifications are: A) Coagulation, Lime Softening or Sedimentation; B) Filtration, Aeration and Filtration or Ion Exchange; C) Chemical Feeding (chlorination/fluoridation/etc.); D) No treatment (pumpage, storage or distribution). Each facility must have at least one certified operator of the appropriate or higher classification to be in compliance with current regulations. IEPA estimates 90% of the facilities to be in compliance at this time.

Potable water supply control in Illinois has proceeded much as was discussed and projected in the previous study. At that time (1974) there was significant activity directed toward training and certification of operators. These efforts have continued.

The stipulations of the Safe Drinking Water Act (SDWA) have caused a flurry of activity. Many water supplies designated by SDWA as public water supplies are not now dealt with as such under Illinois laws and regulations. Thus, monitoring of these supplies will be added to the existing sampling and inspection load. The bulk of these newly designated public water supplies will be in categories assigned to IDPH control; however, the governor designated IEPA as the lead agency.

Two federal grants have been obtained to fund activities related to determining the changes necessary and the feasibility of accepting primacy for SDWA authority. Grant funds were used for the survey by county health departments to locate public water supply sources to be controlled under SDWA, and for a study contracted with the University of Illinois to determine the feasibility of accepting primacy under the conditions of the fifteen principle requirements of SDWA and to identify alternative methods for division of responsibilities under SDWA between IEPA and IDPH.

The four alternatives identified were: 1) all responsibility could be delegated to IEPA; 2) all responsibility could be delegated to IDPH; 3) minimum changes (perhaps trading some current responsibilities such as parks and conservation areas) could be made; and 4) IEPA could be made responsible for all community supplies and IDPH responsible for all non-community supplies. Options three and four are more acceptable to both agencies than either one or two.

Acceptance of state primacy for SDWA would require a substantial increase in IDPH workload and personnel; some, but little increase in workload could be expected for IEPA. Should the state decide not to accept primacy, the water supply programs of the two state agencies would probably continue as they now are. Specific numbers for these changes are discussed in Section C, Workforce Projections.

B. Workforce Profile

Information for the workforce profile was obtained through on-site interviews with personnel of IEPA and IDPH. Mr. Ira Markwood, Division Manager, Division of Public Water Supplies, IEPA, and Mr.

Clinton Mudgett, IDPH, Office of Consumer Health Protection, were especially helpful in the collection and compilation of material for this and other sections.

IDPH authority for control of public water supplies rests upon "An Act in Relation to Public Health" according to which rules and regulations for drinking water, have been promulgated. IDPH operates from the central office in Springfield and through eight field offices. Field personnel are generalists. An inspection of a facility includes a variety of aspects of the facility's operations to be checked by the IDPH employee. Reporting procedures are built around type and number of facilities inspected, not upon time spent in a specific activity such as checking water supplies. Thus, specific data as to number of persons spending how much time in water supply control activities are unavailable.

Each regional office staff includes an average of one engineer, six sanitarians and six or seven inspectors. The engineers hold B.S. or M.S. degrees in environmental, civil or sanitary engineering; the sanitarians hold bachelor's degrees; the inspectors are high school graduates with extensive on-the-job training.

IDPH estimates that the total of public water supply activities conducted by all field personnel combined equals eight to ten person-years per annum.

IDPH laboratory personnel conducting drinking water analyses are located in three laboratories in Springfield, Chicago and Carbondale.

Five people devote full time to water analyses; ten people devote a major portion of their time to water analyses; and an additional twenty people are involved in water sample testing occasionally. Of those professionals employed in the laboratories, three are chemists; the rest are microbiologists. There are fourteen technicians operating as support staff.

Essentially, current IDPH involvement in potable water supply control can be summarized as follows: 29 to 49 people (microbiologists, laboratory technicians, and chemists) are involved in public water sample analysis in IDPH laboratories. An additional eight to ten person-years are devoted to public water supply activities by field personnel.

IEPA jurisdiction over public water supplies is derived from the Illinois Environmental Protection Act. Rules and regulations have been adopted pursuant to "An Act to Regulate the Operating of a Public Water Supply," approved June 25, 1963.

The IEPA, Division of Public Water Supplies, employs 42 persons. Water supply analyses are conducted by persons in the Division of Laboratory Services. Table VII presents the distribution of staff among existing positions.

TABLE VII

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Divisions of Public Water Supplies and Laboratory Services
Potable Water Supply Personnel
Current (1976) Staffing Level

Position	1976
Engineer	
Division of Public Water Supplies	23
Division of Laboratory Services	0
Chemist	
Division of Public Water Supplies	1
Division of Laboratory Services	6
Biologist	
Division of Public Water Supplies	0
Division of Laboratory Services	11
Other	
Division of Public Water Supplies	18
Division of Laboratory Services	7
TOTAL	66

The engineers include persons with degrees in mechanical, civil, chemical and sanitary and environmental engineering at the B.S. or M.S. level. The chemists include people with B.S. through Ph.D. degrees. The biologists have four-year degrees, with the exception of one who has an associate degree and special training. Their degrees are in biology, microbiology, and zoology.

The "other" category for the Division of Public Water Supplies includes thirteen in clerical positions; two professionals in the operator training and certification section whose four-year degrees are not in science; one technician whose functions are in engineering and clerical; one legal advisor; and one professional in data processing. The "other" category for the Division of Laboratory Services includes two technicians, one with two years of college and one with a four-year degree in psychology; and five person-years of administrative and analytical support expended on the Public Water Supplies program annually.

Of the approximate 6,000 water treatment plant operators in Illinois, 2,504 hold active, permanent certificates. Table VIII presents the distribution of certified treatment plant operators by operator classification. Class A is the highest, D the lowest.

TABLE VIII

STATE OF ILLINOIS

Current (1976) Certified Water Treatment
System Operators (active)

Classification		Total
A		718
B		409*
C		1,010
D		368
	TOTAL	2,505

*One class B certificate is of active, limited status. Limited certificates are issued contingent upon fulfilling experience requirements.

The projections for numbers of certified operators in the previous report were made for the end of fiscal years. The figures in Table VIII are for December, 1976. Using half the difference between the projected figures for end of Fiscal Year 1976 and the end of Fiscal Year 1977 to obtain the previously projected figure applicable to December, 1976, one finds a difference of 18 between the projection and the actual number. This is a margin of difference of only 0.007 percent.

Of significant difference, however, is the proportion of the total represented by each category. Table IX illustrates the differences between the projected and the actual certificates by classification.

TABLE IX
STATE OF ILLINOIS
Comparison of Projected and Actual Certified Treatment Operators by Classification

Classification	Projected	Actual
A	721	718
B	479	409
C	744	1,010
D	579	368
TOTAL	2,523	2,505

The differences can be summarized as follows: 70 fewer persons held Class B certificates, 14.6% fewer than projected; 266 more persons held Class C certificates, 36% more than projected; 162 fewer held Class D certificates, 36% fewer than projected. The differences may be attributable to emphasis being placed on upgrading Class D personnel and less emphasis upon upgrading Class C to Class B status than was anticipated at the time the projections were made. Certified operators equal approximately 41% of the total number of persons estimated to be employed in potable water supply (approximately 6,000).

In total there are approximately 6,000 to 6,100 persons working in the public and private sectors in the field of water supply in Illinois.

C. Workforce Projections

Workforce projections are based on the best professional judgement of IEPA and IDPH personnel. Information was obtained through on-site and telephone interviews.

Table X depicts the projected public workforce needs in potable water supplies in Illinois through 1981, based on the assumption that the state will seek primary enforcement responsibility for the Federal Safe Drinking Water Act.

TABLE X
STATE OF ILLINOIS
Public Sector Potable Water Supply Control Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer								
IEPA	23	23	23	23	23	23	2%	n/a
IDPH	0*	0	10**	20	20	20	n/a	n/a
Chemist								
IEPA	7	7	7	7	7	7	n/a	n/a
IDPH	3	3	4	5	5	5	n/a	n/a
Biologist								
IEPA	11	11	11	11	11	11	n/a	n/a
IDPH	15	15	18	22	22	22	n/a	n/a
Sanitarian								
IEPA	0	0	0	0	0	0	n/a	n/a
IDPH	0	0	10	20	20	20	n/a	n/a
Other								
IEPA	25	25	25	25	25	25	n/a	n/a
IDPH	12	12	16	22	22	22	n/a	n/a
TOTAL	96	96	124	155	155	155		

*1976 IDPH figures are estimates derived from data which describe people as working "full-time", "heavily" and "off and on" in water supply activities.

**Sources indicated that 40 additional engineers would be need to comply with SDWA requirements, but that the IDPH "could probably get by with less, i.e., sanitarians." These projections assume half the positions will be filled with engineers and half with sanitarians.

Table X projections are based on the assumption that Illinois will seek primary enforcement for SDWA. If the state does not accept primacy, additional workforce required for implementation and enforcement of SDWA will not be employed by IEPA and IDPH but will be employed in the public sector, either as federal employees or under a federal contract to carry out the functions necessary under SDWA. In short, the people may not be employed by the two state agencies, but they will be a part of the public sector workforce.

The increases shown in Table X occur in 1978 and 1979. This is assumed to be the period of time in which staff build-up is expected to occur to implement SDWA. Hiring may begin in 1977 (but it seems unlikely) and/or hiring may be spread out over a longer period and, therefore, extend into 1980. Whatever the time span, the total through 1981 will probably not be affected. Once the additional workforce level needed to enforce SDWA is attained, the public sector workforce is expected to level off. However, it is reasonable to expect that financial considerations may require the buildup to be spread over a longer (i.e., 15-year) period.

The "other" category includes chemical and field people now employed plus additional technicians and perhaps an attorney.

The 2% turnover rate for IEPA engineers is not expected to change. The turnover rate for IDPH employees is unknown but has been increasing as salaries have become less competitive over the past three years.

No increase is shown for IEPA personnel. The Public Water Supplies Division is not expected to expand during the time frame under consideration; the bulk of the increased workload due to SDWA is expected to fall upon IDPH but, again, staff increases may not occur until later years. Should primacy be accepted and there be a resultant change in jurisdictional responsibilities of IDPH and IEPA, some of the positions projected for IDPH may fall to IEPA.

IEPA personnel indicate that 90% of the public water supply facilities are in compliance with current state regulations. IEPA estimates a 5% per annum increase in certified operators. Table XI presents workforce projections for certified treatment plant operators through 1981.

TABLE XI

STATE OF ILLINOIS

Certified Water Treatment Plant Operators
Workforce Projections to 1982 (est.)

Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
A	718	734	751	769	788	808	n/a	13%
B	409	440	473	508	544	582	n/a	25%
C	1,010	1,013	1,016	1,019	1,022	1,025	n/a	2%
D	368	443	522	605	692	783	n/a	16%
TOTAL	2,505	2,630	2,762	2,901	3.046	3,198	n/a	5%

The projected per annum growth rate is 5%. Specific turnover rates are not available, but it is reportedly much higher in the lower classifications. The overall rate is about 10%. The primary cause for turnover is thought to be the salary level.

The aggregate percentage increase over the five year period is 28%. This is quite close to the aggregate increase of 27% projected in 1974 for the period from 1974 through 1980.

The percentage increases within each classification vary from what actually occurred over the last two years. It is assumed that the greater emphasis upon upgrading from D to C classification and the less than anticipated upgrading from Class C to B will not continue. Rather, it is probably that the percentage increases within classification will be more in line with those projected in 1974. The increases presented in Table X are shown as a steady rate. This may not be an accurate representation, i.e., in any given year, upgrading from one classification to another may receive greater attention than others. Thus, one year may show an increase at significant variance with the projected increase. However, these changes in emphasis are expected to balance out over the five year period, the result being the same as if change occurred at a consistent rate.

Although SDWA will require an increase in sampling, some of which will be added to the workload of the existing private sector workforce, the increases in the workforce due to SDWA will occur in the public sector as shown in Table X.

D. Training and Certification

IEPA, Division of Public Water Supply, is actively engaged in training of water treatment operators. Such involvement by the agency is described as "a vacuum filling situation." At the present there is no other mechanism for provision of adequate training. The Environmental Resources Training Center (ERTC) at Southern Illinois University-Edwardsville is expected to relieve IEPA of much of its training responsibilities. However, ERTC is only in its first year of restricted operation. Full programs will take some time to develop. IEPA training activities include co-sponsoring short courses (12 - 16 weeks, one night per week) with community colleges, conducting one-day training seminars, conferences, compilation and distribution of training materials.

In 1975, 16 community college courses were offered. In FY 1976, the program was expanded to 19 courses offered throughout the state. The courses are divided as to basic or intermediate level training. The former is designed to prepare the trainee for Class C or D certification; the latter, for Class A or B. In FY 1976, 265 persons enrolled in the basic courses; 141 in the intermediate. IEPA provides the syllabi for these courses.

IEPA one-day or evening seminars are offered at community college campuses. In FY 1975, 26 were conducted with an attendance of 1,075 and a total of 4,061 training hours. In FY 1976, 28 seminars were attended by 1,134 persons who received a total of 4,666 training hours.

The three conferences held annually are attended by operators, consulting engineers, vendors, and municipal officials. Total attendance at the FY 1976 conferences was approximately 900 (many persons attended all three).

TABLE XII

IEPA OPERATOR TRAINING PROGRAMS

Program	FY 1976 Attendance
Conferences (2 and 3 day)	900
Community College Courses	406
Seminars (1 day or evening)	1,134
TOTAL	2,440

It should be noted that many people attended two or more of these programs.

In addition to the programs conducted by IEPA or co-sponsored with the community colleges, IEPA distributes instructional materials upon request.

There are twenty-five water treatment operator groups whose members are from a one to three county area. These groups hold monthly meetings for social and occupational education functions. They make extensive use of IEPA materials.

These materials, as well as those used in the other program, provide aids for instruction in a variety of aspects of water treatment. Examples are: pump selection and use, waterworks distribution, softening, sampling, and mathematics.

IEPA estimates training efforts will continue to be substantial to keep up with the 10% turnover and 5% annual increase in certified operators.

E. Career Potential

Growth in the public sector will be dependent upon and limited to conditions imposed by decisions regarding SDWA. If the state accepts primacy for SDWA enforcement, 55 to 60 people may be added to the IDPH portion of the public sector workforce. Most of these will be positions for engineers or sanitarians, micro-biologists and laboratory technicians.

It is not known what the effect will be on the private sector. Certified water treatment operators are expected to increase at a rate of 5% per annum.

Replacements for the 10% per annum turnover of certified personnel will be needed. The bulk of these are at the entry level. Non-certified personnel positions (particularly laborers/maintenance and management) will probably continue to increase at a rate of less than 5% per year.

Figure 3 is an example of an organization chart for a large, well-staffed plant which includes treatment, distribution and laboratory facilities. This chart is applicable to a plant serving a city of seventy-five thousand or more.

F. Conclusion

Much of what is in store for employment in potable water supplies in Illinois over the next 5 years is explicitly dependent upon the enforcement of SDWA. At this time the effects of SDWA cannot be well anticipated. All that is certain is that there will be an increase of 55 to 60 people in the public sector.

The mechanisms for training water treatment operators have not changed since 1974. There remains much room for improvement. Full-time instructors are still needed to teach advanced programs. The newly completed Environmental Resources Training Center (Southern Illinois University-Edwardsville) can be expected to meet this challange when it is operated at a fuller capacity.

AN ORGANIZATIONAL PLAN FOR A MODEL PUBLIC WATER SYSTEM

Figure 3.

SOURCE: Illinois Environmental Protection Agency (IEPA)

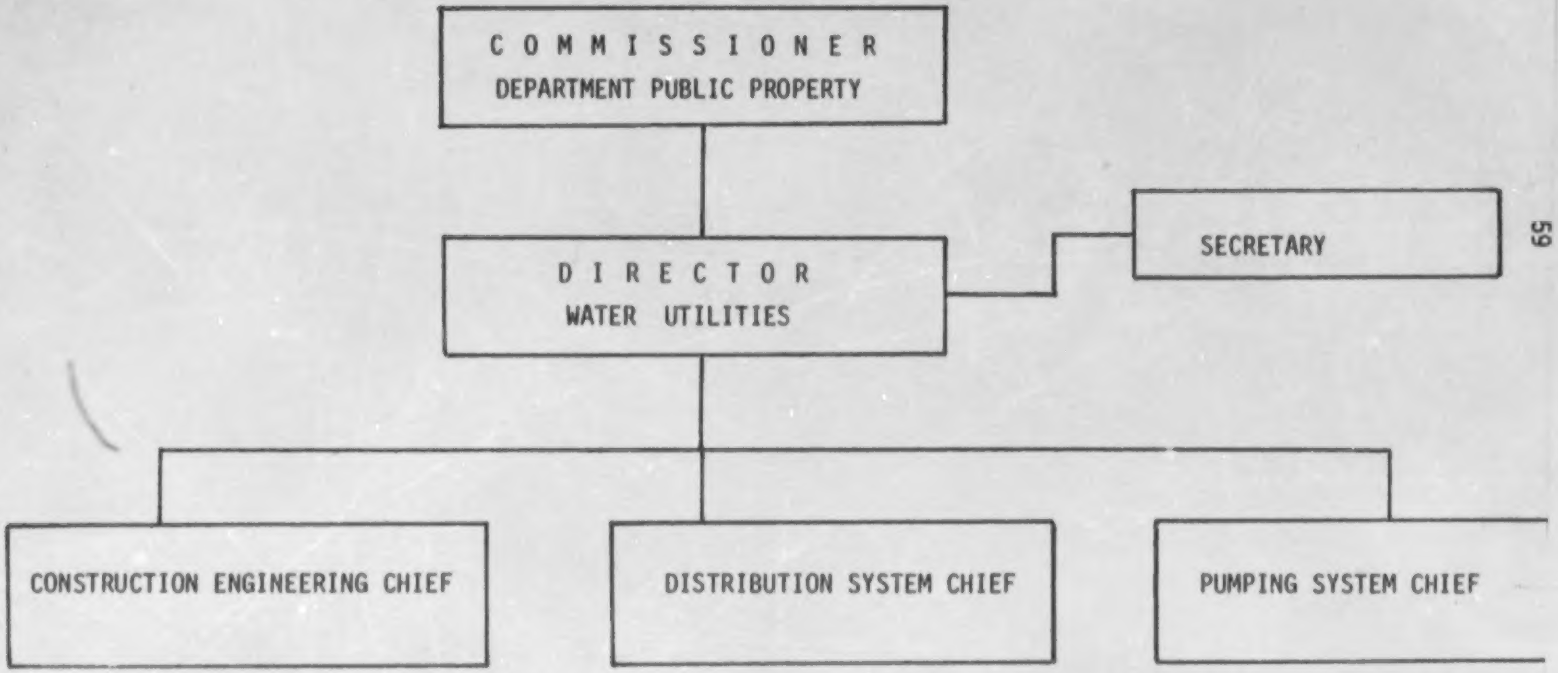

COMMISSIONER
DEPARTMENT PUBLIC PROPERTY
SECRETARY
DIRECTOR
WATER UTILITIES
CONSTRUCTION ENGINEERING CHIEF
DISTRIBUTION SYSTEM CHIEF
PUMPING SYSTEM CHIEF

Figure 3 (Continued)

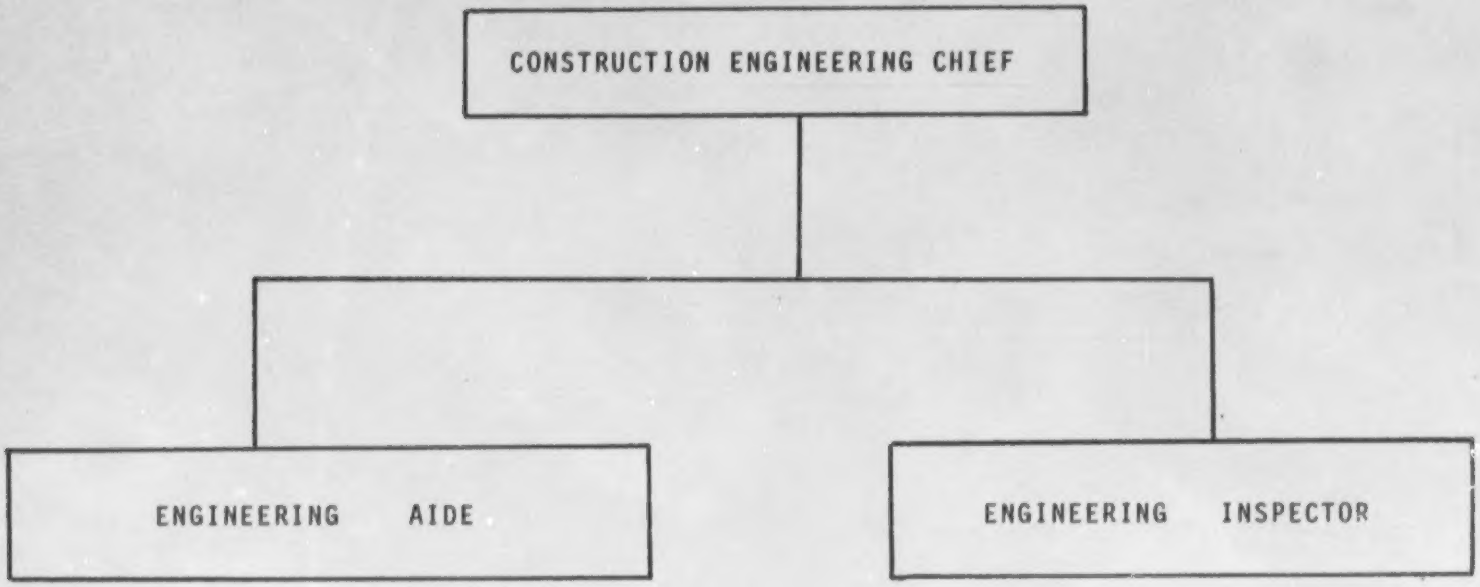

CONSTRUCTION ENGINEERING CHIEF
ENGINEERING AIDE
ENGINEERING INSPECTOR

Figure 3 (Continued)

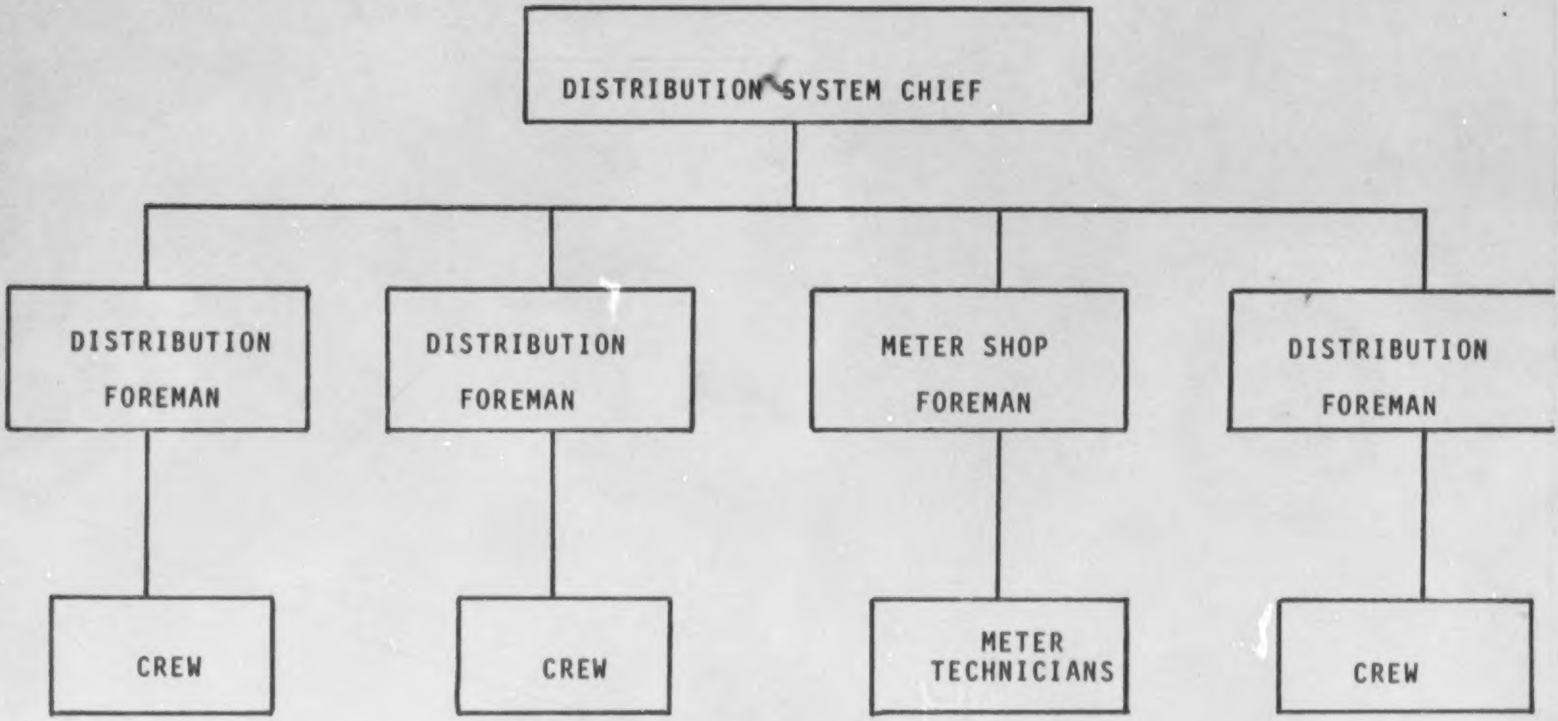
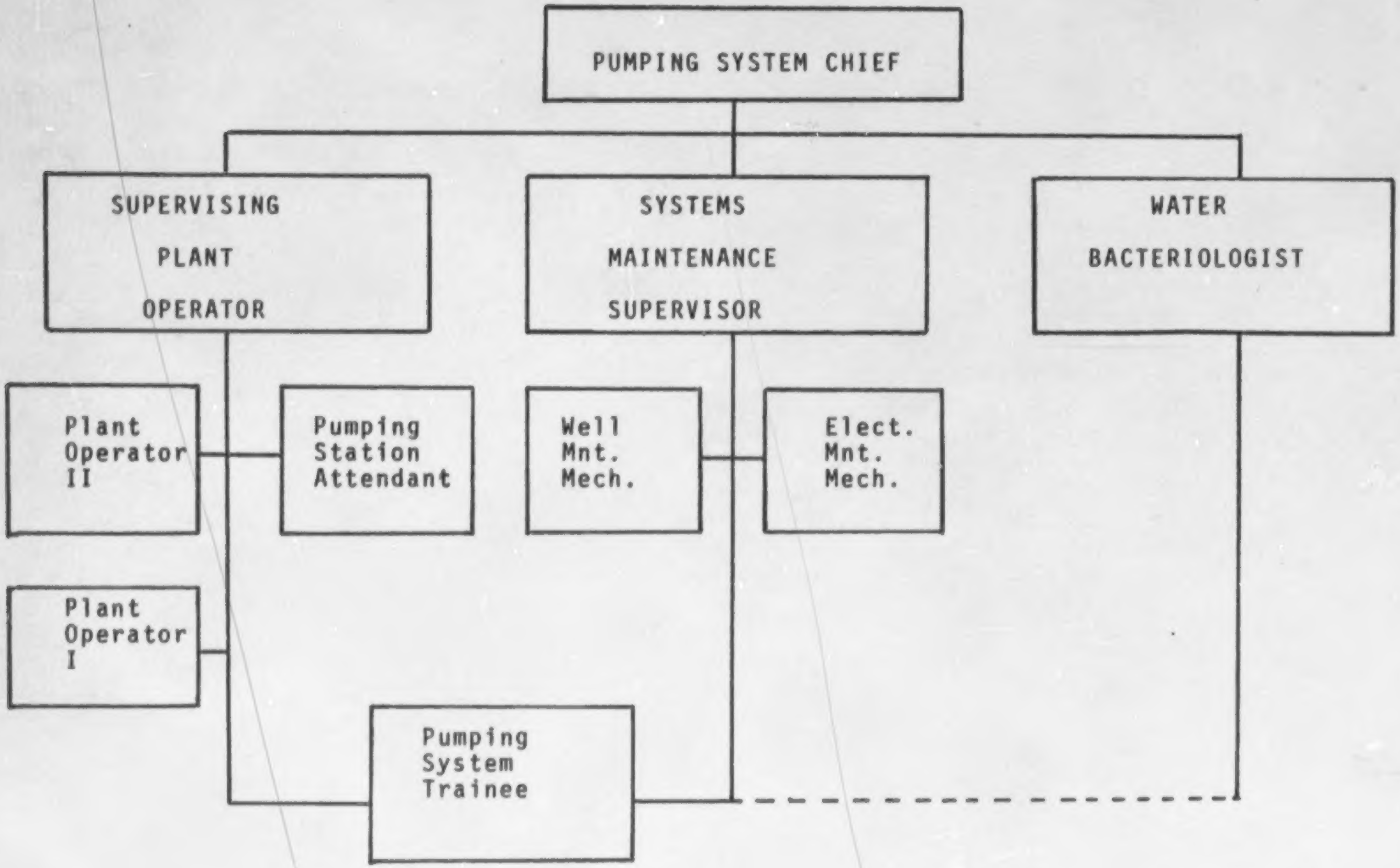

DISTRIBUTION SYSTEM CHIEF
DISTRIBUTION FOREMAN
DISTRIBUTION FOREMAN
METER SHOP FOREMAN
DISTRIBUTION FOREMAN
CREW
CREW
METER TECHNICIANS
CREW

Figure 3 (Continued)


PUMPING SYSTEM CHIEF
SUPERVISING PLANT OPERATOR
SYSTEMS MAINTENANCE SUPERVISOR
WATER BACTERIOLOGIST
Plant Operator II
Pumping Station Attendant
Well Mnt. Mech.
Elect. Mnt. Mech.
Plant Operator I
Pumping System Trainee

V. RADIATION

A. Introduction

Illinois has an exceptionally large and rapidly expanding nuclear industry that began with the first sustained nuclear fission reaction, under the direction of Enrico Fermi of the Manhattan Project in 1942.

Currently there are seven nuclear power reactors operating at three sites in Illinois; eight more reactors are under construction, and two more are planned.

In addition, there are three major radiopharmaceutical firms; a large uranium-hexafluoride conversion facility; a nuclear spent fuel storage facility (originally designed as a fuel recovery plant); two major nuclear related federal research installations; a low-level nuclear solid waste disposal site; and two nuclear power reactor personnel training facilities, operated in conjunction with above-mentioned facilities. (Refer to Figure 4 on the following page)

There are 7,400 facilities registered with the Illinois Department of Public Health which use radiation for medical purposes and an additional 700 which use radiation for industrial purposes.

This heavy emphasis upon the nuclear industry within the state and Illinois' central location within the country have created a situation whereby transportation of nuclear materials is also of major proportions and concern.

Illinois is not a Nuclear Regulatory Commisison (NRC) agreement state. Efforts were made to negotiate an agreement in FY 1976, but an agreement was not reached. No funds were appropriated by the State for FY 1977 to

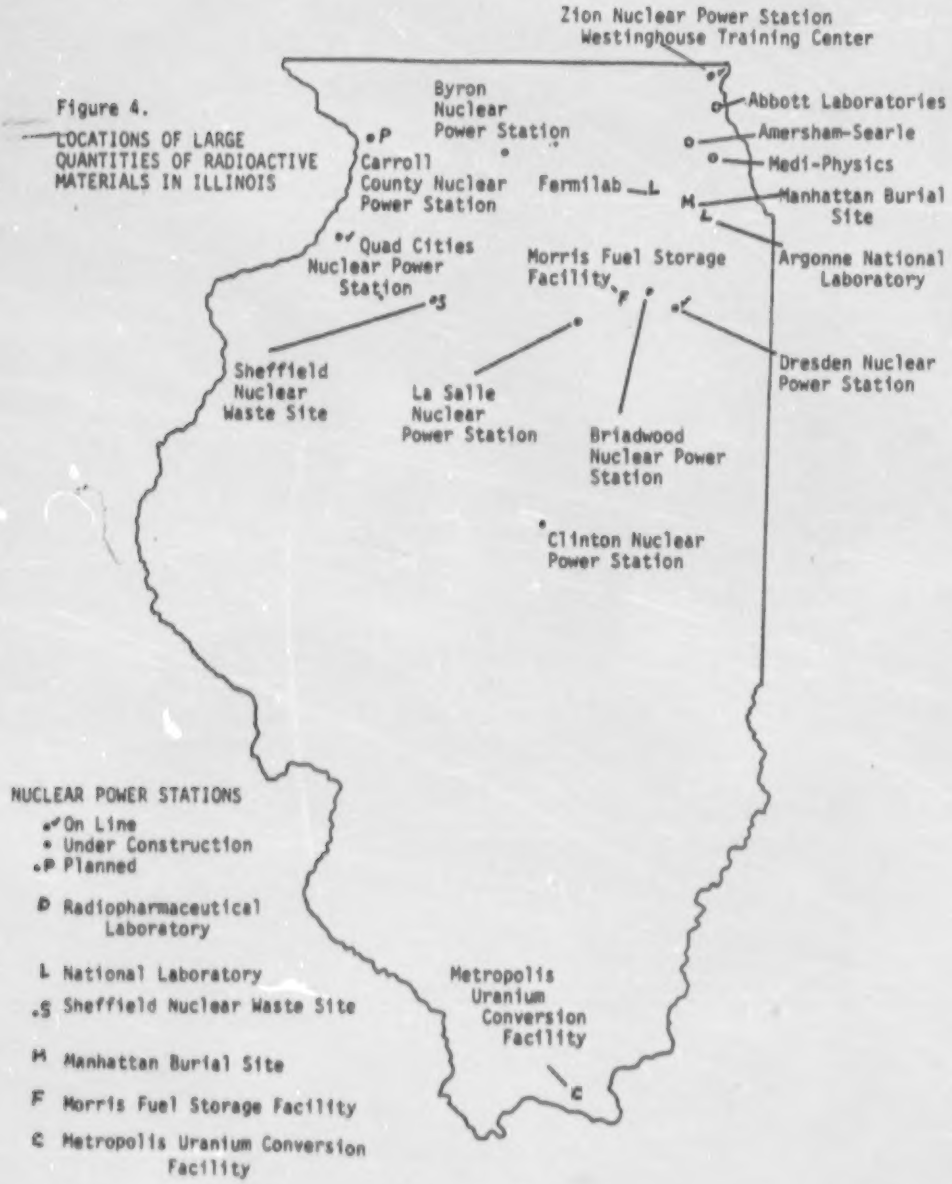


Figure 4.
LOCATIONS OF LARGE QUANTITIES OF RADIOACTIVE MATERIALS IN ILLINOIS

Zion Nuclear Power Station
Westinghouse Training Center
Abbott Laboratories
Amersham-Searle
Medi-Physics
Manhattan Burial Site
Argonne National Laboratory
Byron Nuclear Power Station
Carroll County Nuclear Power Station
Fermilab
Quad Cities Nuclear Power Station
Morris Fuel Storage Facility
Sheffield Nuclear Waste Site
La Salle Nuclear Power Station
Briadwood Nuclear Power Station
Dresden Nuclear Power Station
Clinton Nuclear Power Station
Metropolis Uranium Conversion Facility
NUCLEAR POWER STATIONS
•✓ On Line
• Under Construction
•P Planned
D Radiopharmaceutical Laboratory
L National Laboratory
•S Sheffield Nuclear Waste Site
M Manhattan Burial Site
F Morris Fuel Storage Facility
C Metropolis Uranium Conversion Facility

fulfill the requirements for implementing measures necessary under agreement conditions. Funding to do so is being sought for FY 1978, but is not expected to be forthcoming.

The Illinois Department of Public Health (IDPH) holds legislated responsibility for regulation of radiation sources in the state. The Illinois Environmental Protection Agency (IEPA) also has statutory authority to regulate nuclear energy facilities that largely overlaps IDPH statutes, but the Pollution Control Board determined, on the basis of a court decision (Northern States Power vs. Minnesota), that EPA's authority may be unconstitutional. The provision in question in the Illinois Environmental Protection Act is being overlooked.

IDPH authority is derived from four statutes: the Radiation Installation Registration Law of 1957, which requires registration of radiation facilities with IDPH; the Radiation Protection Act of 1959 and its subsequent amendments, which gives IDPH its basic authority to monitor and control radiation sources; the Personnel Radiation Monitoring Service Act of 1963, which requires monitoring of employees in radiation facilities; and the Radioactive Waste Act of 1963, which gives the state a mandate to acquire low-level radioactive waste disposal sites to be supervised by IDPH.

The governor has designated IDPH as the lead agency for nuclear affairs, with the responsibility for reviewing and coordinating state programs and activities related to nuclear safety.

IDPH divided its radiation related functions in December, 1975, into two divisions. The Division of Radiological Health retained responsibility for medical and other non-energy related uses of radiation; the newly created Division of Nuclear Safety is responsible for health and safety related to nuclear energy and the uranium fuel cycle.

The Division of Radiological Health (DRH) was established subsequent to the passage of the Radiation Installation Registration Law in response to a recognized potential hazard to the health of Illinois citizens due to the increasing use of radioactivity in medical procedures.

X-ray machines used for medical diagnosis are the major sources of man-made radiation exposure to the general public. Illinois citizens receive an average of one X-ray examination every two years. The Division of Radiological Health regulates the use of more than 13,000 X-ray machines in use in the 7,400 medical/dental facilities registered with IDPH. More than 5,500 machines are inspected by IDPH personnel yearly. Inspections include determination of compliance with the Department's rules and regulation, measuring patient and employee exposure levels, evaluating the total radiation hygiene program, and educating users of X-ray equipment as to technical improvements.

The Division has made extensive use of its computer facilities to research and develop unique regulations of patient exposure levels for dental and medical examinations. The Division maintains the only state data bank on patient exposure information which includes more than 20,000 radiation exposure measurements for specific radiologic examinations. These data were used to develop and promulgate dental exposure regulations, effective January 1975. A recent effectivness study determined that an approximate 50% reduction of patient exposure has occurred as a result of the dental regulation and similar trends are apparent for the medical regulations. The federal government is considering adopting similar regulations based on those of Illinois for application to all federal health care facilities. The U.S. EPA, other states, and the Mayo Clinic have consulted with IDPH in their efforts to establish similar requirements and procedures.

In 1973, the Illinois Radiation Protection Act was amended to require licensure for the use of naturally-occurring and accelerator-produced radionuclides (principally radium, radon, and a large number of "machine-produced" radionuclides) which had previously been exempt from any licensure requirements. The Division of Radiological Health has issued more than 300 licenses and established a statewide compliance program. Many incidents of improper control, particularly with radium, have been eliminated.

The Illinois Department of Public Health has become increasingly concerned with the transportation of radioactive materials. The Division of Radiological Health, under federal contract, conducted a study of radioactive materials transportation at and around O'Hare Field and other Chicago land-transport terminals. The Division has noted a significant reduction in the number of accidents at O'Hare in radioactive materials handling since the study. A second study, in conjunction with the Illinois Department of Transportation and the Illinois State Police, involved monitoring vehicles at interstate weigh stations.

Both studies indicated that increased state activity in radioactive materials transportation control is desirable. In November, 1975, the IDPH promulgated a new regulation which created full state authority over all interstate and intrastate transport of radioactive materials. Full recognition by the Federal Highway Administration (FHA) resulted in a "Memorandum of Understanding" which was formally signed by the FHA in September, 1976.

In 1976, IDPH concluded negotiations with the NRC and the U.S. Department of Transportation to obtain specialized equipment for the Illinois State Police for statewide surveillance programs. This arrangement will be discussed further in Section D.

IDPH rules and regulations for personnel monitoring represent a unique effort in radiological health control. Persons employed as radiation workers are required to wear a "film badge", which utilizes X-ray film to measure exposure, or a thermoluminescent dosimetry (TLD) device containing small lithium fluoride or calcium fluoride crystals which measure radiation exposure. All radiation exposure reports are entered in IDPH's electronic data processing center.

The Radiological Health Division has written and printed six booklets in a series called, "Topics in Radiological Health". The booklets are excellent educational reference materials in the areas of personnel monitoring, dental radiography, care of radiation accident patients, laser safety, the underage radiation worker and microwave safety. The booklets have been widely distributed. The microwave safety booklet has been requested by several other states for distribution. A seventh in the series, intended for nurses caring for patients receiving radiation treatments, is being developed.

The Division of Nuclear Safety has the assigned mission to provide lead agency coordination in radiation related matters which involve other state agencies. The Division is actively involved in and is responsible for review and recommendations for upgrading the following nuclear safety related activities:

1) Monitoring and surveillance of nuclear facilities
2) Radioactive waste disposal and storage
3) Nuclear facility emergency preparedness and response
4) Investigation of nuclear facility abnormal occurrences

5) Transportation of radioactive materials
6) Nuclear pressure vessel and piping inspections.

Coordination activities have included involvement in multi-agency activities related to the Clinton Nuclear Power Station, radioactive waste discovered in West Chicago's Reed-Keppler Park, and the decommissioning of a Kerr-McGee West Chicago thorium processing facility.

IDPH has monitored operating nuclear facilities for more than eighteen years. NRC relies upon IDPH monitoring and surveillance activities for data. Currently, comprehensive monitoring of water, air, milk, and food is being conducted at the three power reactor sites. Surveillance activities have been expanded to include the LaSalle County station site to provide reference data for when the plant goes on line.

A complete monitoring program has been developed at Allied Chemical's uranium-hexafluoride facility at Metropolis. Partial programs have been instituted in West Chicago and near Argonne National Laboratory. Continuous air sampling is done using TLD devices; water samples are taken. Nearly 1,500 samples including fish, milk, vegetation, and sediment, are Safety personnel estimate that each new plant brought on line will increase the samples collected by about 500. Plans are being made to expand the reactor surveillance program to include the upcoming reactors at Byron, Braidwood, and Clinton. NRC is providing $20,000 per annum for surveillance work done by IDPH.

The Division of Nuclear Safety maintains a health and safety inspection program for nuclear facilities consisting of quarterly inspections at nuclear power stations and the radioactive waste sites (the Sheffield low-level solid waste site and the burial site for the residue for the Manhattan Project); semi-annual inspections at the Metropolis uranium coversion facility; and annual inspections of the University of Illinois Research Reactor and the Westinghouse Training Reactor. Unplanned inspections are made when nuclear facilities have certain abnormal occurrences.

The Sheffield Nuclear Waste Site in Bureau County is one of six in the nation. The site is on twenty acres of state-owned land and is operated by a contractor. Only solid waste may be buried with a maximum concentration of one Curie per cubic foot.

The IDPH has a rigid supervisory program over the operation of the site. Description of IDPH supervision and of the actual operation of the site is included in the report on solid waste, hazardous materials.

The Illinois Commission on Atomic Energy (IAEC) was established in 1957. The Act establishing the Commission was amended in 1971 to make it a permanent body and again in 1974 to alter its responsibilities to, (the Commission shall)... "investigate the economic, social, health, and technological impact of atomic energy resources and related facilities on the citizens of this State; and any other issues which are related to the purpose of this Commission."

The IAEC consists of 14 members and nine ex-officio members. Four members are appointed from the General Assembly. The citizen members, appointed by the governor, must include: two representing industry, two representing labor; two representing science and technology; two representing medicine and health; one representing the insurance industry and one representing the legal profession. The ex-officio members are heads of state agencies whose responsibilities may involve activities related to radiation control and nuclear energy development.

IAEC employs an executive director and one secretary. The Commission is mandated to submit a biennial report to the governor and the General Assembly. It may submit other reports as it deems desirable.

The Commission has been responsible for developing and promoting much of the State's radiation control and nuclear energy legislation. Recent efforts have included proposals for hazardous materials legislation (this has become law and is discussed below) and power plant siting, applicable to nuclear and fossil fuel plants, alike.

The Commission is highly supportive of continuing efforts to establish a Midwest Nuclear Compact (MNC). The MNC would include 13 midwestern states and would:

1) Improve relations among the members regarding nuclear issues;
2) Provide an umbrella organization to establish standardized regulations for all participants (weight limits on vehicles is of special importance);
3) Provide a united front and, therefore a stronger voice at the federal level.

Two such compacts, one in the West and a similar one in the South, have been formed.

The IAEC initially opposed NRC agreement status. Changes at the federal level in NRC agreement policy have caused IAEC to reverse its position; the Commission is now strongly advocating Illinois becoming an NRC agreement state. The Commission's view is that the interests of the health and safety of the people of Illinois would be better served under agreement status.

The Illinois Emergency Services and Disaster Agency (IESDA) was established in 1975 (the enabling act is appended). IESDA assumed the duties and responsibilities of the Illinois Civil Defense Agency and was given statutory authority much broader in scope than its predecessor.

IESDA is mandated to determine needs and establish programs for disaster prevention, preparation, response, and recovery. The Agency's emergency response network is frequently called upon to deal with situations involving hazardous materials, including sources of radiation.

The Illinois Hazardous Materials Act of 1976 further specifies IESDA's role in hazardous materials incident emergency response and authorizes the Illinois Department of Transportation (IDOT) and IESDA to promulgate appropriate regulations for placarding the use, storage, and manufacture of hazardous materials.

IESDA has been called upon on numerous occasions to respond to simulated and actual radiological accidents. The majority of the accidents occur during transportation of the material. The Agency's educational and training efforts, as they relate to radiation, are discussed in Section D.

Other state agencies, most notably the Illinois Department of Transportation, are involved in radiation control as a small portion of their overall responsibilities. Such activities are coordinated with IDPH, IAEC, and IESDA.

The National Accelerator Laboratory (NAL) was officially dedicated to the memory of Enrico Fermi and renamed the Fermi National Accelerator Laboratory (Fermilab), May 11, 1974. The laboratory site (6,800 acres) near Batavia was presented to the federal government by the State of Illinois in 1969.

Argonne National Laboratory (ANL) is a major multi-purpose laboratory operated under contract with the Energy Research and Development Administration (ERDA). ANL is the national center for liquid metal fast breeder reactor (LMFBR) research and development. Argonne is developing and expanding programs in a broad variety of energy production and conservation. ANL is discussed more fully in the report on energy.

The nuclear spent fuel storage facility, owned and operated by General Electric near Morris, in Grundy County, was constructed as a fuel recovery plant, but is operating as a temporary storage facility for spent nuclear fuel.

The uranium-hexafluoride conversion plant at Metropolis conducts the first steps in the fuel enrichment process. The product is then shipped to Kentucky for further processing; much of it is then returned to Illinois in the form of fuel for nuclear power generating plants.

The three principle suppliers of radioactive isotopes in Illinois are Abbott Laboratories in North Chicago, Amersham-Searle in Arlington Heights and Medi-Physics in Rosemont.

Figure 5 presents the most frequently traveled routes used in the transportation of nuclear materials in Illinois: Chicago is the largest and East St. Louis, the second largest rail center in the nation; thus, Illinois is the center of interstate shipping of nuclear materials by railroad. O'Hare Field is the busiest airport in the world, and is located near three of the largest producers of radioactive isotopes. Illinois is also in a keystone position with regard to the interstate highway system.

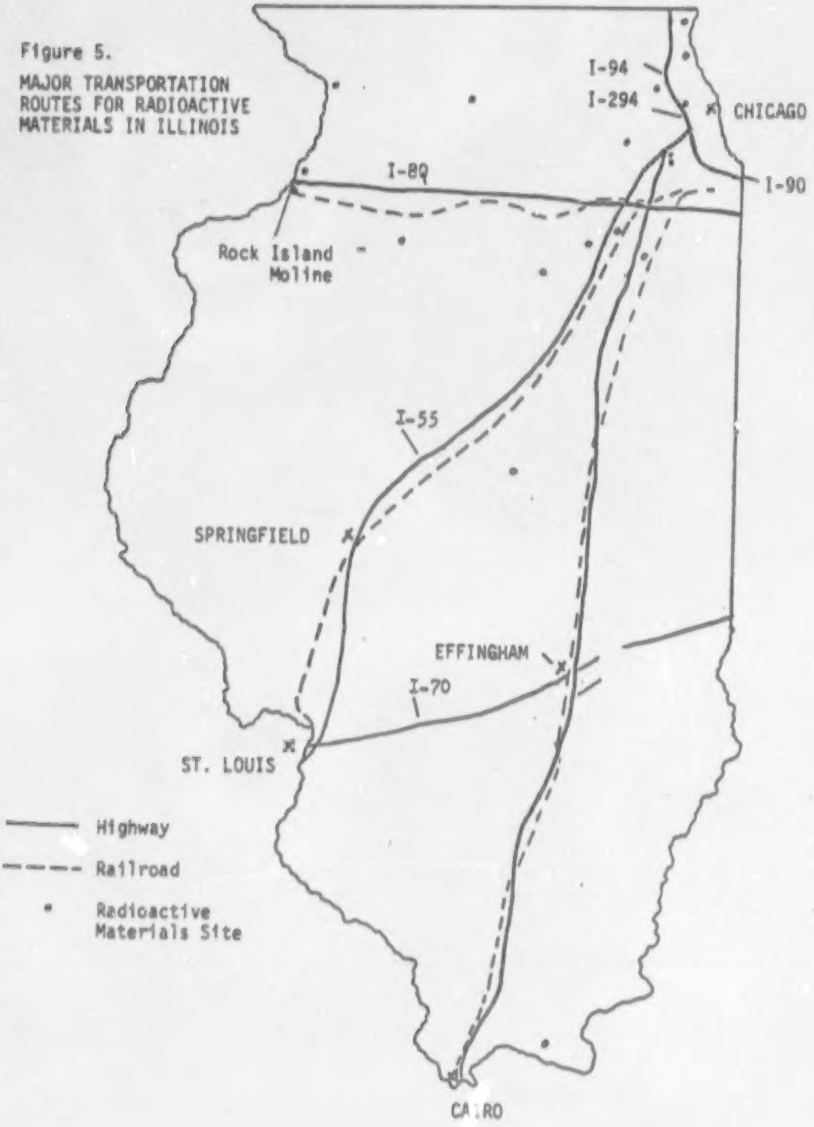


Figure 5.
MAJOR TRANSPORTATION ROUTES FOR RADIOACTIVE MATERIALS IN ILLINOIS

I-94
I-294
CHICAGO
I-80
I-90
Rock Island
Moline
I-55
SPRINGFIELD
EFFINGHAM
I-70
ST. LOUIS
CAIRO
Highway
Railroad
Radioactive Materials Site

B. Workforce Profile

Information for the workforce profile and other sections was obtained through on-site interviews with persons working in a variety of areas within the field. Mr. Philip Brunner, Chief, Division of Radiological Health, and Mr. David Ed, Mr. Pete Tedeschi and others of the Division of Nuclear Safety (all of the IDPH) were especially helpful. Of particular assistance were Mr. Gerald Day, Executive Director, IAEC, and Mr. E. Erie Jones, Director, IESDA.

Table XIII shows the staffing level of the two IDPH divisions and the laboratory support engaged in radiation control.

TABLE XIII

ILLINOIS DEPARTMENT OF PUBLIC HEALTH

Divisions of Radiological Health and Nuclear Safety
and Laboratory Support
Current (1976) Staffing Level

Position	DRH	DNS	Laboratory	Total
Physicist	7	1	0	8
Chemist	0	1	1	2
Engineer	0	3	0	3
Technician	13	1	1	15
Other	3	1	0	4
TOTAL	23	7	2	32

The Division of Radiological Health personnel include three people with degrees in nuclear medical technology, one B.S. in physics, one B.S. in chemistry, one B.S. in nuclear technology, and an M.S. in science education. One with a B.S. in nuclear medical technology also has an M.A. degree in public administration.

The Health Physics Technicians have a minimum of two years of medical X-ray technology training. There are 15 field technician positions authorized (the primary function is inspecting X-ray machines); three positions are vacant and cannot be filled at this time due to the job freeze in effect for most state agency positions. The vacancies are due to the loss of salary competitiveness over the past two to three years.

Division of Nuclear Safety personnel include one health physicist, three nuclear engineers, one chemist, one technician and one secretary. The laboratory support of the division is one chemist and one technician.

The Illinois Commission on Atomic Energy (IAEC) staff consists of the executive director and one secretary.

The Emergency Services and Disaster Agency (IESDA) staff of 60 includes several positions of which radiation control is a part of the regular duties. Among them are the executive for hazardous materials, five technicians who calibrate geiger counters, three planners and the nine Mutual Aid Regional Coordinators in field positions.

Specific private sector radiation control workforce figures are unavailable. Roughly 20,000 people work with or in close proximity to radiation sources in medical or dental facilities. Approximately 7,500 others work at nuclear power plants, research facilities, and other installations in the state.

IDPH personnel estimate there are twenty to thirty persons who work as consultants and calibrate X-ray machines.

Personnel classification data for the Quad Cities Nuclear Power Generating Station (a typical operation), indicate 22 persons assigned to radiation protection. The radiation protection section at a nuclear power plant typically includes one lead health physicist and three other health physicists; a lead chemist and three other chemists; and additional radiation protection men with no degree requirements, but with special training.

Based on the Quad Cities plant, it is estimated that there are approximately 60-70 persons employed in radiation protection in nuclear power stations in Illinois.

It is not known how many people are involved in radiation protection in other nuclear facilities in the state. However, 60-80 is a reasonable estimate, based on the number of people employed in nuclear facilities. Thus, the total involved in radiation protection in nuclear power stations and other radiation facilities is 120-150.

C. Workforce Projections

The public and private sectors of radiation protection will sustain an increase in the next few years. It is impossible to project increases for specific years as most of the increases will be dependent upon new nuclear power stations coming on line. Slippage can be expected to set back planned start up for one or all of the plants. Another aspect affecting the public sector workforce is the possibility of Illinois becoming an NRC agreement state.

Workforce projections for the public sector are as set forth in Table XIV.

TABLE XIV

ILLINOIS DEPARTMENT OF PUBLIC HEALTH

Divisions of Radiological Health, Nuclear Safety,
and Laboratory Support (combined)
Workforce Projections to 1982 (est.)

Positions	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Physicist	8	8	8	8	8	9	n/a	n/a
Chemist	2	2	2	2	3	3	n/a	n/a
Engineer	3	3	3	3	3	4	n/a	n/a
Technician	15	15	18	19	19	19	n/a	n/a
Other	4	4	4	5	5	5	n/a	n/a
TOTAL	32	32	35	37	38	40		

Currently there are three vacancies in the Division of Radiological Health due to field technicians leaving the public sector for better salaries. Table XIV reflects the assumption that these authorized positions, now subject to the job freeze, will be refilled by the end of 1978. The increases indicated for 1979, 1980, and 1981 represent increases in staffing of the Division of Nuclear Safety and laboratory services which will be necessitated by Illinois becoming an NRC state. Some increases in workload due to a new nuclear power plant reactor in operation may occur as early as 1979. However, the other reactors are currently scheduled for start up in 1980, 1981, and 1982. It is likely that subsequent workload increase for the Division of Nuclear Safety's monitoring activities will not require additional personnel until 1982. Slippage in the construction and start up of the plants could set the need for increased IDPH workforce back even more.

The radiation protection workforce in the private sector is likely to increase dramatically. The number involved in X-ray calibration and consulting may increase slightly. The major changes will occur in the facilities producing nuclear power, those engaged in aspects of the nuclear fuel cycle, and those engaged in research. The current private sector radiation workforce of 120-150 will increase as much as 80 persons as the nuclear power stations now under construction prepare to come on line.

The Morris facility may expand but the likelihood is tempered by present zoning regulations. Fermilab is adding personnel as it expands its research activities. Argonne National Laboratory expects an overall growth of about 5%, some of which will be in radiation protection.

The private sector radiation protection workforce in nuclear power stations, fuel cycle facilities and research facilities could reach 225-250 persons by the end of 1981 or 1982.

It should be noted that many of those presently employed in radiation protection in the private sector were recruited from those trained in the U.S. Navy's nuclear program. It is not known if this recruitment will continue as in the past. The Navy has been critical of recruitment procedures which have a negative effect upon re-enlistment.

D. Training and Certification

Training activities in radiation protection are as widespread and varied as might be expected in such a multifaceted field.

The IDPH staff have participated in numerous training sessions across the nation. They routinely engage in internal cross-training. Individual areas of expertise are shared. Much of the in-house training is part of a monthly program conducted for the 13 IDPH employees who comprise the Illinois Radiological Assistance Team (ILLIRAT). ILLIRAT members, on 24-hour call, respond to radiological emergencies in addition to their regular duties.

The team offers training for other state agencies and user groups upon request. Training sessions are most often attended by local rescue squads and hospital personnel.

IDPH has participated in special training programs for State policemen in which included radiation detection and protection. Under an agreement with the federal government, equipment has been purchased and mounted in State Police cruisers for monitoring radioactive materials with sodium iodide detectors.

In the past, IAEC has co-sponsored a series of seminars on peacetime nuclear incidents with the Illinois Civil Defence Agency. IAEC also worked with that agency in Illinois State Police training. A three-part seminar, "Atomic Energy in Illinois: Benefits and Risks", developed by Sangamon State University, was presented to the Illinois State Legislature by IAEC in 1974. The IAEC has not engaged in this type of educational activity recently.

The Emergency Services and Disaster Agency (into which the Civil Defense Agency was merged) regularly includes radiation protection as a part of its training for staff and for thousands of volunteers throughout the state.

Persons receive training in radiation protection in the universities, community colleges and public and private technical training schools.

The Westinghouse Electric Corporation, Nuclear Service Division (described more fully in ENERGY), provides training in radiation protection for nuclear power plant employees. Some training in radiation protection is conducted at the Westinghouse Nuclear Training Center in Zion, Illinois. The full radiation protection program is offered at the Westinghouse training facility in Pittsburgh, Pennsylvania.

E. Career Potential

Career opportunities in radiation protection will continue to develop in Illinois throughout the 1980's. Total employee increase due to the four nuclear power plants under construction (the last scheduled for completion in 1982) is estimated at 1,400 persons. Of these at least 80 will be in radiation protection positions.

Expansion at the other facilities is expected to necessitate approximately 20 to 30 more people. Thus, expansion in the private sector is expected to add a minimum of 100 persons specifically responsible for radiation protection between 1977 and the early 1980's. These positions include chemists and health physicists with at least four-year degrees, technicians with two-year degrees, and persons without degrees but who have received extensive specific training.

F. Conclusion

Nuclear energy, radiation-based medical procedures, and nuclear research are expanding enterprises in Illinois. These, the nuclear fuel cycle facilities, and the increasing volume of radioactive materials being transported throughout the state, combine to make radiation protection careers a significant and growing proportion of the workforce.

Programs for training and retraining radiation personnel will need expansion as a consequence. Programs in radiation protection must meet the demand for qualified people, relay developments in the field, and educate the public at large.

As the nuclear industry continues to grow in Illinois, the demand for well-educated and well-trained personnel in the public and private sector will increase. Career opportunities appear quite good in the field.

VI. SOLID WASTE

A. Introduction

The Illinois Environmental Protection Agency's Division of Land Pollution Control activities regarding solid waste disposal have not changed since the original Illinois report, written in 1974. There are fewer solid waste disposal sites; more are larger operations which employ several people. The Sheffield low-level radioactive waste disposal site supervised by the Illinois Department of Public Health, not discussed in the earlier report, is included below.

Illinois has 465 solid waste disposal sites. Of these, 134 are listed as illegal due to one or more factors which disqualify the site from eligibility for a permit for operation as a sanitary landfill site. The bulk of these are relatively small private sites, many of which may not now be in use. Publicly owned and/or operated sites (31 percent of the total sites) account for 20 percent of the illegal sites.

The closing of promiscuous dumps (those in greatest violation of Illinois Environmental Protection Agency standards) has, with few exceptions, been dealt with and is no longer a major emphasis of the agency's activity.

Slightly more than half the sites are defined as municipal or general; the others are demolition sites. The former generally handle wastes which will putrify; the latter deal with materials such as bricks, glass, or metals which are either recovered, recycled, or converted.

The IEPA estimates that more than sixty percent of the solid waste handled in Illinois is generated in the six-county area including and surrounding Chicago. Approximately forty firms (many operate several sites) serve this area and employ up to fifty percent (4,500-5,000) of the statewide solid waste labor force.

The safe disposal of hazardous materials and liquid wastes is now considered of primary concern to IEPA and the relatively few firms who handle them. The volume of these materials is rising and a fatal accident has occurred at a landfill in Illinois involving liquid wastes.

Illinois is expected to receive about $1,250,000 in federal funds for assistance in dealing with hazardous materials disposal under a provision of the federal Resource Conservation and Recovery Act of 1976 (RCRA) which will allocate monies for that purpose based upon population.

Resource recovery activities in Illinois are increasing, but very slowly. Ferrous metals are the major category of materials recovered. High quality paper recycling is done on a small scale; some sulfur recovery for the burning of high-sulfur coal is done in the Wood River area. Some sources feel that only after RCRA is implemented, with the effect of increasing the costs of solid waste disposal, will resource recovery become economically advantageous. RCRA will not be implemented for two years; full impact will of course require more time.

RCRA is expected to effect an increase in numbers of people involved in legal, planning, and engineering aspects of solid waste management and cause an increase in the size of site crews. Regional planning efforts are expected to result in sites which are larger in area and fewer in number.

The increase which has occurred in the resource recovery workforce over the past year has, for the most part, been due to the completion of the City of Chicago/Commonwealth Edison Refuse Derived Fuel (RDF) project which is now on line. The power generation plant operates on fuel consisting of ninety percent coal and ten percent solid waste. It burns 1,000 tons of solid waste per day. A similar, but smaller volume plant (Dallman Power Generation Station #3) to serve Springfield is about two years from start up. It will burn 250 tons of solid waste per day.

Increasing awareness by the public of solid waste problems is evidenced by support for a bill now in committee in the Illinois legislature. It would require a minimum of a $.05 deposit on beverage containers and is similar to measures adopted by Oregon and Michigan. Chances of passage are not known at this time; the bill is heavily opposed by segments of the beverage industry. A similar ordinance is being considered for the city of Champaign.

B. Workforce Profile

Information for this section was obtained during interviews with landfill owner/operators and IEPA personnel. Mr. George Edema, Browning-Ferris Industries, and Mr. Bert Fowler, Waste Management of Illinois, were particularly helpful. Discussions with Mr. Thomas E. Cavanagh, Jr., manager of the Permits Division of Land/Noise Pollution Control, IEPA, were invaluable.

The Division of Land Pollution Control is charged to:

1) promote the conservation of natural resources;
2) prevent the pollution of misuse of land;
3) minimize environmental damage by reducing the difficulty of disposal of wastes;
4) encourage and effect the recycling and re-use of waste materials;
5) upgrade waste collection and disposal practices.

Table XV presents the current (1976) public sector workforce in solid waste pollution control.

TABLE XV

IEPA DIVISION OF LAND POLLUTION CONTROL
Current (1976) Staffing Level

Position	1976
Engineer	7
Chemist	1
Geologist	2
Sanitarian	12
Attorney	2
Technician	7
Other	5
TOTAL	36

Solid waste pollution control is divided into three categories: Collection, Disposal, and Resource Recovery/Energy Conversion (RR/EC). Current private sector workforce levels were estimated with the help of IEPA personnel.

As for collection, it is estimated that presently there are about 10,000 people employed as chaffeurs, helpers and jumpers, and in management. This figure was arrived at by using Springfield (population about 130,000) employing an average crew size of two for some forty trucks with an estimated thirty people involved in management as an index for the state (population 11,000,000).

There are approximately 2,220 people employed throughout the state in disposal activities at the 465 solid waste disposal sites. To determine this estimate it was assumed that each site had an average crew size of 4.75. Such positions might be owner/operator, weighmaster, equipment operator/mechanic, laborer, spotter, materials handler and assistants to the owner or operators. Crew size varies considerably. Twenty or more may be employed at a large urban area site; a single individual working part-time may be responsible for operating a small rural site.

The RR/EC workforce level is presently estimated at approximately seventy-five. This figure represents individuals working full-time at fifteen or sixteen landfill sites where RR/EC activities are conducted and those employed at the City of Chicago/Commonwealth Edison RDF plant.

The following table presents the current private sector workforce profile.

TABLE XVI

STATE OF ILLINOIS

Current (1976) Private Sector Solid Waste Workforce

	1976
Collection	10,000
Disposal	2,220
RR/EC	75
TOTAL	12,295

Specific information as to position title was not available as many functions are combined, even in the larger operations.

The Division of Nuclear Safety, Illinois Department of Public Health, supervises operation of the Sheffield low-level radioactive waste disposal site in Bureau County. The site was authorized by the 1963 Radioactive Waste Act; operations began in 1967 under a lease agreement with a private contractor, Nuclear Engineering Company Inc. Only solid waste with a maximum concentration of one Curie per cubic foot may be buried on the state-owned twenty acre site.

IDPH conducts quarterly site inspections, collects on- and off-site samples, and conducts periodic special programs of audit, inventory, and analyses. The IDPH personnel whose responsibilities include the above are discussed in the Radiation component of this study.

The operator, Nuclear Engineering Company, is required to monitor the site and to provide IDPH with extensive reports, records, and inventories of location, amount and types of waste buried. The site is nearing capacity under current conditions and methods of burial; expansion is hampered by zoning regulations. A program to expand the capacity of the twenty acre site is being developed, but will require regulatory approval before the "cut and fill" plan may be implemented.

Although verbal and written requests were submitted to Nuclear Engineering, for information regarding the Sheffield site workforce, the company failed to respond. IDPH estimates the Sheffield site workforce to be about 30; no expansion is anticipated.

C. Workforce Projections

The IEPA positions in solid waste management are not expected to increase more than two or three percent per year over the next few years. An exception to this may be due to the addition of personnel as a result of RCRA toward the end of the five year period. This is unpredictable at this time.

The following table depicts the expected increases in the public solid waste management workforce. The rate of increase is expected to be between two and three percent per year. It is not certain in which job categories the increases will occur.

TABLE XVII

STATE OF ILLINOIS
IEPA Division of Land Pollution Control
Solid Waste Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum growth (average)
Engineer	7	7	7	7	8	8	n/a
Chemist	1	4	4	4	4	4	n/a
Geologist	2	9	9	9	9	9	n/a
Sanitarian	12	2	2	2	2	2	n/a
Attorney	2	2	2	2	2	2	n/a
Technician	7	7	7	8	8	8	n/a
Other	5	6	7	7	7	8	n/a
TOTAL	36	37	38	39	40	41	2-3%

The total employment situation in the private sector of solid waste management, which includes projected growth, turnover, upgrade training, job attrition and termination, based on best professional judgements is reflected by the following table. Specific job classification data are unavilable.

TABLE XVIII

STATE OF ILLINOIS

Private Sector Solid Waste Workforce Projections to 1982 (est.)

	1976	1977	1978	1979	1980	1981	%/annum growth (average)
Collection	10,000	10,700	11,449	12,250	13,108	14,025	n/a
Disposal	2,220	2,264	2,309	2,355	2,402	2,450	n/a
RR/EC	75	75	75	90	*	*	n/a
TOTAL	12,295	13,039	13,833	14,695	15,510	16,476	

*Dependent upon the effects of the implementation of the Federal Resource Conservation Recovery Act which cannot be estimated at this time.

The preceding projections for collection activities are based on a straight line two percent increase in staffing needs and an annual turnover/attrition rate of five percent. The disposal figures are based on a straight line two percent increase. The larger operations predict an annual growth at landfill sites ranging from five to ten percent; however, some of this growth will be offset by abandonment of smaller sites. The 1979 figure for RR/EC reflects the opening of the Springfield refuse derived fuel plant. Growth beyond that year may be extraordinary due to the effects of RCRA, but are unpredictable at this time.

The figures are not broken down by position title as many functions are combined, even in the larger operations.

Illinois Environmental Protection Agency positions are not expected to increase in the near future. An exception to this may be due to the addition of personnel as a result of RCRA.

All indications are that growth in solid waste management will be small (about 2 percent) for the next few years with the notable exception of a dramatic increase in RR/EC activities and positions toward the end of the five year period.

D. Training and Certification

Certification for owner/operators appears to be a matter of low priority according to IEPA administrators. At the present owner/operators are required only to obtain an appropriate permit to operate a sanitary landfill. Formal certification is not yet required and permits are issued if the individual/company is able to meet the standards for operating a sanitary landfill.

IEPA has offered one and two-day seminars for owner/operators at several locations across the state. These seminars, conducted by IEPA staff, reviewed rules and regulations governing operation, explained developments in the field and presented manuals, lectures and films dealing with correct landfill operation, e.g., RR/EC activities, materials handling, landscaping and site reclamation. IEPA has trained more than 550 owners/operators in this fashion.

E. Career Potential

Many positions in solid waste disposal are filled by people moving up through the ranks, often by those who began as jumpers or drivers. Much hiring is done through union halls. The larger companies may begin to hire engineers, geologists and hydrologists, but only one or two per company and only as a need is perceived by management. Those companies which handle hazardous and liquid wastes will be hiring chemists and technicians for testing materials before disposal, but this, too, will have minimal impact. Chemists with an understanding of solid waste disposal requirements and techniques will be particularly sought after.

Central processing and resource recovery from wastes, when implemented, will change the employment profile of those companies involved in these activities extensively.

F. Conclusion

The most significant changes in solid waste management in Illinois will be due to implementation of the Resource Conservation and Recovery Act. Resource recovery activities will increase and effect an increase in workforce demand for chemists, planners, hazardous waste management specialists, engineers, and complex machine operators.

Solid waste management programs, such as those already begun under the aegis of the federal government, will become increasingly important as landfill operations become more diversified and complex. Future regulations, both at the state and federal level, will require the training and formal certification of all Illinois sanitary landfill owner/operators as well as additional training for those entering the solid waste field. These changes will not begin to be felt until at least 1979 or 1980.

VII. WASTEWATER

A. Introduction

The field of wastewater processing in Illinois has proceeded much as was discussed and projected in the first Illinois report. The proposed changes in certification classification for operators have been instituted; the training program developed by the Illinois Environmental Protection Agency (IEPA) outlined in the first report has been implemented. The development with the greatest impact is the completion of the Environmental Resources Training Center (ERTC) for pollution control operator training. These changes will be discussed at length below.

Illinois does not now have National Pollution Discharge Elimination System (NPDES) authority and is giving very careful consideration to the problems and benefits derived from acquiring such authority. At the present, it appears unlikely that the state will accept primacy. The effects upon the workforce, whether primacy is accepted or not, are not clear.

There are approximately 2,400 municipal and private treatment plants in Illinois. One-half are staffed by as many as thirty a shift, operating around the clock; the others are one or two-man operations.

The previous IEPA, Division of Water Pollution Control, estimate of 10,000 people employed in the 2,400 facilities across the state still holds. As of December, 1976, IEPA records showed 2,201 wastewater treatment plant personnel to be certified operators. This apparent reduction from the 2,431 reported in the previous study is due to an extensive effort by IEPA personnel to clear the certification files of inactive certificates. It was estimated at the start of the file clearing that as many as ten percent would be found to be inactive; in fact, the number far exceeded ten percent. The December, 1976, total of 2,201 is of active certificates and represents a substantial increase over the active certificates included in the number reported previously.

The IEPA 1974 estimate that 3,000-5,000 people already in the field will need further education to meet future requirements in wastewater processing is still considered valid.

B. Workforce Profile

Information for the workforce profile was obtained through interviews with IEPA, Division of Water Pollution Control, personnel. Mr. Ernest Bennett, P.E., Manager of the Operator Certification and Training Unit, was especially helpful in providing an understanding of wastewater programs in Illinois. The assistance of Mr. Bennett and Mr. James O'Bryan in compiling data was of the highest quality.

The IEPA Division of Water Pollution Control is organized into five regions and maintains seven offices. They are as follows:

Region I--Rockford
Region II--Maywood (Also covers the area formerly served by the Aurora office which has been closed)
Region III--Springfield, Champaign, Peoria
Region IV--Collinsville
Region V--Marion

The Division of Water Pollution Control currently has a head count of 196 persons, of which 142 are engineers, administrators and scientists. The 54 remaining are clerical/para-professional. Table XIX illustrates the distribution of staff within the Division.

TABLE XIX

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Division of Water Pollution Control
Current (1976) Staffing Level

Position	Field Offices	Main Office	Total 1976
Engineer	33	43	76
Resource Planner	0	9	9
Environmental Protection Specialist	19	8	27
Attorney	0	9	9
Administrator	0	4	4
Accountant	0	6	6
Environmental Protection Technician	11	2	13
Aquatic Biologist	6	0	6
Clerical	15	31	46
TOTAL	84	112	196

The resource planners have a minimum of a four-year degree in resource planning or urban planning. Environmental protection specialists have Bachelor's or Master's Degrees in the natural sciences or chemistry. Environmental protection technician positions require a high school education and extensive on-the-job training. The aquatic biologists have a minimum of a four-year degree.

The Division of Water Pollution Control responsibilities include the following:

1) Approval of construction plans specifications for new facilities to ensure compliance with state regulations;

2) Certification and training of wastewater treatment operators;

3) Monitoring to ensure compliance with water quality standards;

4) Enforcement of regulations regarding properly certified personnel for wastewater treatment facilities.

The staffing level will probably remain constant for some time due to the job freeze affecting all state employment.

Table XX presents the distribution of certified wastewater treatment plant operators in Illinois by operator classification (I is the highest).

TABLE XX

STATE OF ILLINOIS

Certified Wastewater Treatment Plant Operators
Current (1976) Staffing Level

Classification	1976
I	173
II	318
III	422
IV	858
VII	430
TOTAL	2,201

As of September, 1974, Illinois operator certification classifications were reduced from seven to five categories, I-IV and VII. Class V certificate holders were upgraded by examination or declared uncertified and dropped. A total of 396 were dropped; many of whom have since regained certification. Class VI temporary certificates were eliminated.

IEPA personnel estimate the 2,201 certified operators to include as many as 200 degreed engineers and up to 500 college and university trained biologists, chemists and laboratory technicians. There are no data available concerning the breakout of treatment facilities' employees as to administration, labor, or maintenance.

The Chicago Metropolitan Sanitary District (MSD) controls certification of operators under its jurisdiction. Efforts are being made to institute a reciprocal arrangement between the MSD and IEPA regarding certification examinations and validity of certificates.

Figures 6 through 11 present an organizational chart for a wastewater treatment plant serving 100,000 population. The chart was developed by IEPA, Division of Water Pollution Control.

C. Workforce Projections

The staffing level in the public sector is likely to remain constant for some time (see Table XX) due to budgetary constraints, although IEPA personnel anticipate a need for additional people to deal with future developments within the program.

Workforce projections for the private sector are indicated in Table XXI. They are based on past trends as evidenced by IEPA certification records. The projections reflect adjustments in the growth rates to correct the factor of error due to previously counted inactive certificates.

TABLE XXI
STATE OF ILLINOIS
Wastewater Treatment Plant Operators (Certified)
Workforce Projections to 1982 (est.)

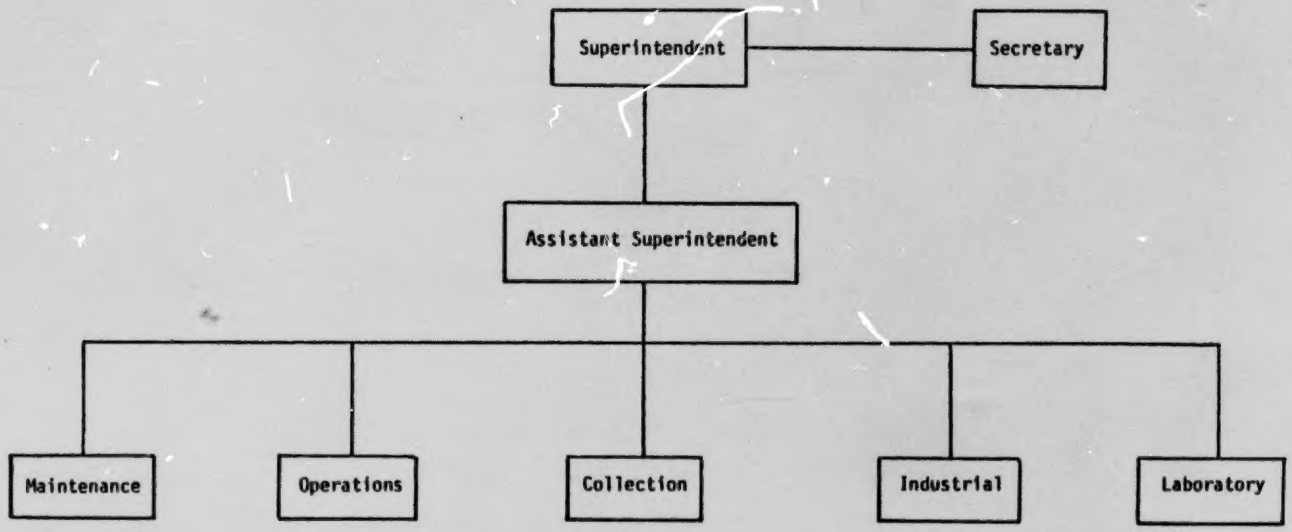
Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
I	173	187	202	218	235	254	n/a	8%
II	318	351	388	429	474	524	n/a	10.5%
III	422	468	520	577	640	710	n/a	11%
IV	858	905	955	1008	1063	1121	n/a	5.5%
VII	430	484	545	613	690	776	n/a	12.5%
TOTAL	2201	2395	2610	2845	3102	3385		9%

The above table depicts only certified operators which presently comprise 22 percent of the total private sector workforce. The table represents changes due to new entry and upgrading. The projected per annum growth for the next five years for certified wastewater treatment operators is 9 percent,

ORGANIZATIONAL CHART

Waste Water Treatment Plant: 100,000 population

Figure 6

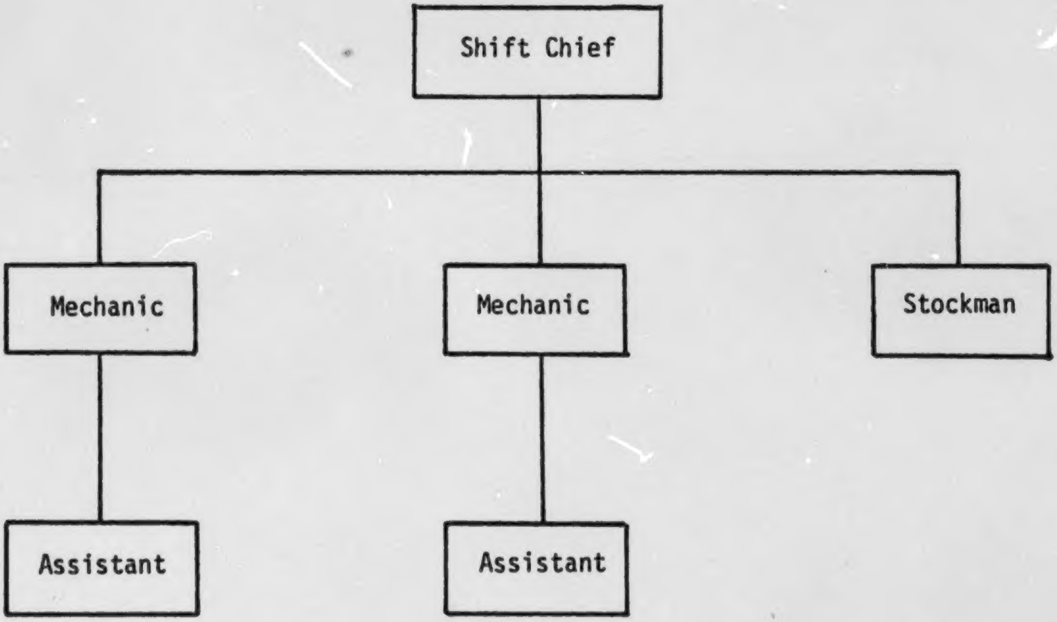

Superintendent
Secretary
Assistant Superintendent
Maintenance
Operations
Collection
Industrial
Laboratory

Source IEPA

Model Waste Water Treatment Plant

(Maintenance Division)

Figure 7

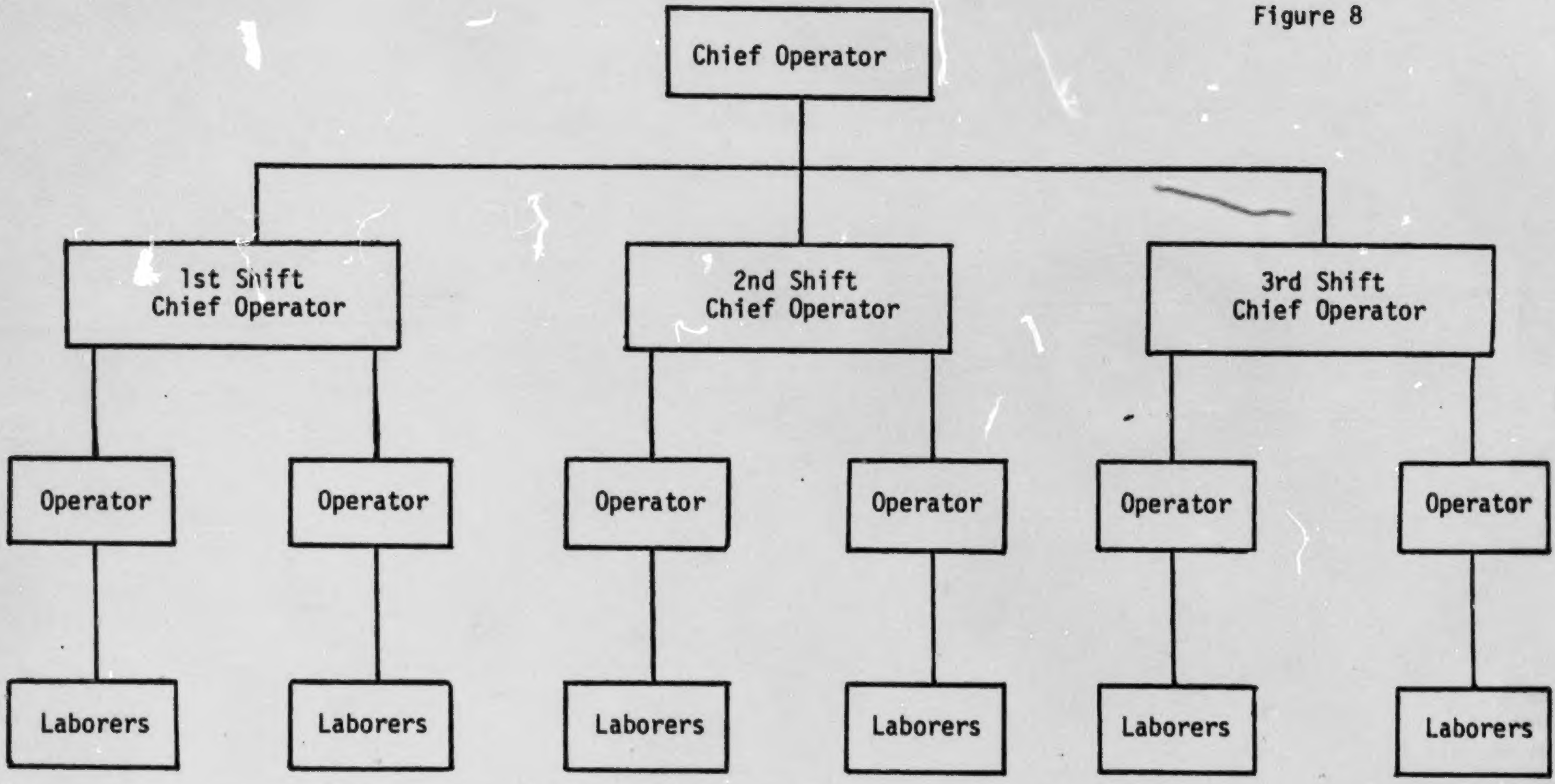

Shift Chief
Mechanic
Mechanic
Stockman
Assistant
Assistant

Source IEPA

Model Waste Water Treatment Plant

(Operations Division)

Figure 8

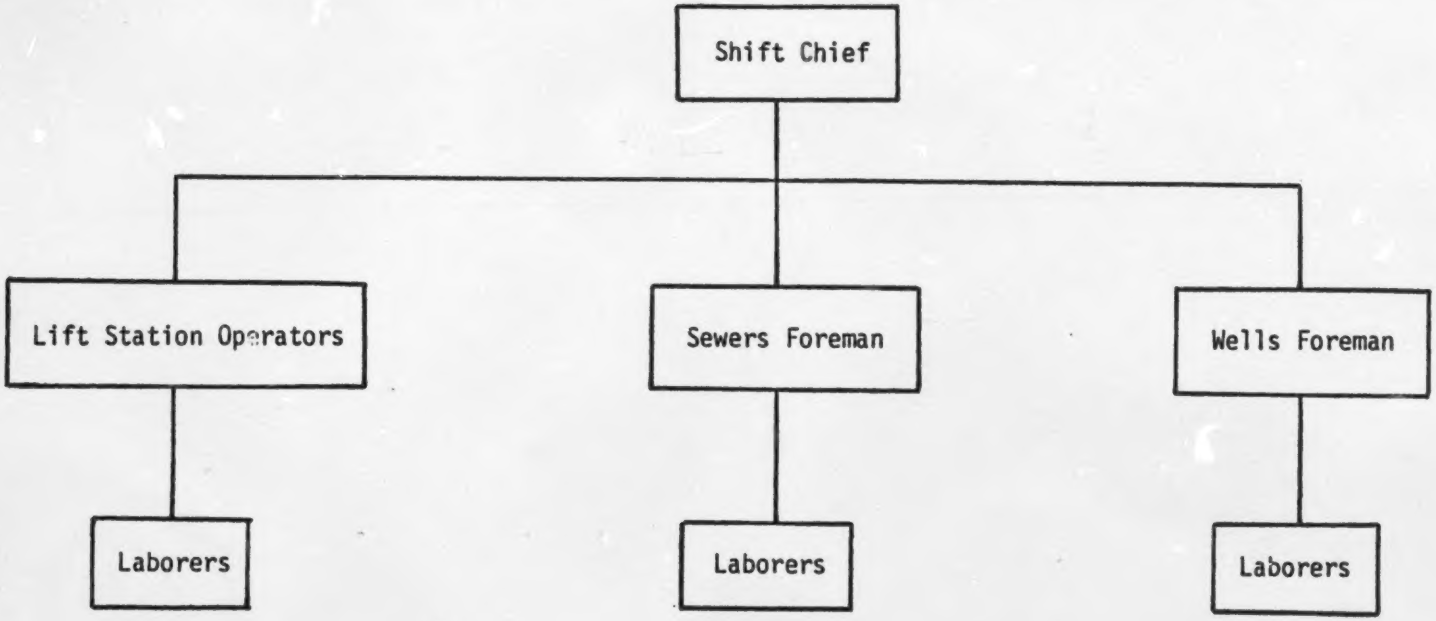

Chief Operator
1st Shift Chief Operator
2nd Shift Chief Operator
3rd Shift Chief Operator
Operator
Operator
Operator
Operator
Operator
Operator
Laborers
Laborers
Laborers
Laborers
Laborers
Laborers

Source IEPA

Model Waste Water Treatment Plant

(Collection Division)

Figure 9

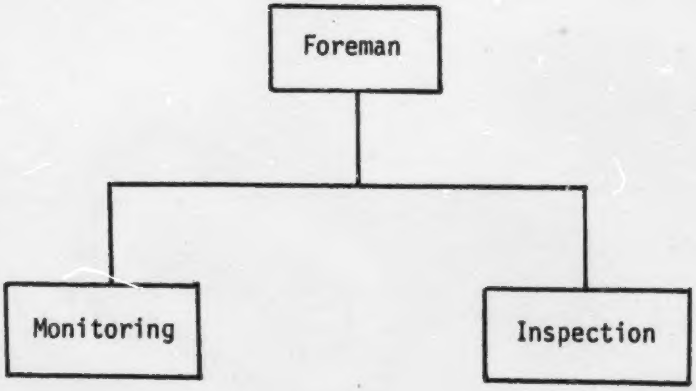

Shift Chief
Lift Station Operators
Sewers Foreman
Wells Foreman
Laborers
Laborers
Laborers

Source IEPA

Model Waste Water Treatment Plant

(Industrial Division)

Figure 10

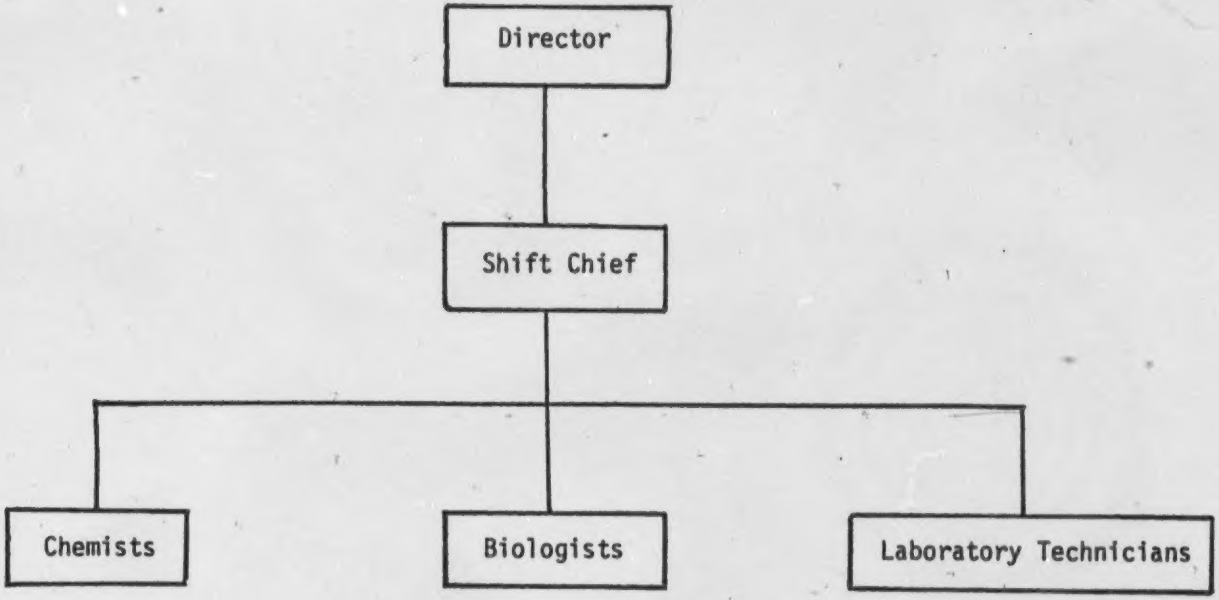

Foreman
Monitoring
Inspection

ource IEPA

Model Waste Water Treatment Plant

(Laboratory Division)

Figure 11


Director
Shift Chief
Chemists
Biologists
Laboratory Technicians

Source IEPA

in aggregate. No specific turnover rates are available. Turnover is highest in classifications III and IV, primarly due to low salaries in municipal plants compared to similar positions in industry.

Specific workforce profiles and projections cannot be determined for wastewater treatment plant positions other than certified operators. Growth will occur in administrative, labor, and maintenance positions but such growth will not be at a rate equal to the growth of the number of certified operators. The basic reason for disproportionate growth rates is due to IEPA's intensive efforts to train existing operator personnel to meet the requirements of certification; thus, a major proportion of the increase in certified operators is composed of persons already working in the field.

D. Training and Certification

The Illinois wastewater report prepared in 1974 outlined the IEPA plan for broadened training and certification efforts to be implemented in FY 1975. The plan consists of five separate but interrelated elements; Element I is complete and Element II is well underway. The plan has been most successful to date and is reprinted here with notations as to the current status of the various elements.

Element I (Completed June 30, 1976)

Management Incentives: To substantially increase the awareness and support of municipal officials in the need for optimum operation and maintenance of wastewater treatment facilities through 20-25 seminars reaching approximately 1,000 to 1,200 officials.

The Element will be structured around 20-25 seminars combining slide, tape, and live presentations. The individual seminars will be designed to: 1) appeal to and train municipal officials in manpower planning for wastewater pollution control; 2) enlist municipal officials in support of pollution control efforts; 3) acquaint officials with the specific purposes, needs and benefits of pollution control facilities and pollution control operators. Specifically, it will include the incentives and benefits to be realized by enrollment in the operator training program, particularly Element III.

The seminars, which are planned for presentation during the first four to six months of the project, will be led by one or more individuals (e.g. engineers, operators, etc.) knowledgeable about State and Federal regulations, and wastewater treatment facility operation and maintenance procedures.

Element II (On-going--will be completed June 30, 1977) Instructor Development: To train or upgrade the level of 24 operator instructors through the development and demonstration of innovative instructor development techniques. After development, these instructor techniques will be available to train additional replacement instructors.

An estimated 3,000 to 5,000 operators of wastewater treatment facilities require or will require some form of initial or upgrade training over the next several years. It is a generally conceded concept that it is more feasible to provide technically trained and experienced operators with instructor skills and capabilities, than to technically qualify experienced instructors in facility operation. Furthermore, since not only technical knowledge but operational experience is a vital factor in a viable, practical training program, it may be readily discerned that the utilization of experienced operators as operator instructors is to be encouraged.

Element III (To be completed June 30, 1977)

Operator Training/Assistance: To optimize the operation and maintenance of 50 wastewater treatment facilities through intensive operator training and assistance, and to provide varying degrees of in-plant, in-depth, specialized assistance to an additional 100 facilities. This Element will also be utilized to improve operator assistance capabilities of Agency staff, particularly staff not currently experienced in this area.

This Element will consist of two categories. Category A will consist of 50 wastewater treatment facilities where operation and maintenance problems are extensive or severe in nature. Priority will be given to those operators at plants where requests for grant funds have been made and where: a) it is unlikely that grant funds will be available within the reasonable future; b) the facility has available design capacity; c) it appears that operation and maintenance can be significantly improved through intensive operator training and assistance.

The fiscal year 1975 grant priority list will be screened for possible candidates among those grant applications with priority numbers of greater than 300. Additional candidates will be nominated by IEPA staff considering such factors as: a) design available capacity; b) relative difficulty and expense of correcting any physical plant deficiencies; and, c) general operator related operation and maintenance deficiencies.

Approximately 50 facilities and operators will be selected by not later than 30 days after the completion of Element I for inclusion in Category A. Facilities and operators will not be accepted into the program until both the operator and the facility owner have concurred with the program objectives and intent, and agreed to participate fully. When a facility and operator have been so enrolled, both the operator and his plant will be pre-evaluated to establish base-line performance. Based upon evaluation, a training routine and schedule will be developed for the specific operator and facility. Subsequent achievement evaluations will be made to determine improvements in operation and maintenance. Such evaluations (pre-, continuing, and post-evalutions) will include both objective and subjective appraisals. Objective evaluations may include, but will not necessarily be limited to, appraisals of final effluent and stream condition. Subjective evaluations will include appraisals of the operator, facility, and supportive activities of the facility owner by program staff. Enrollees and municipal officials enrolled in the program may also be asked to evaluate achievements. Evaluations will consider such items as facility monitoring reports, record keeping activities, laboratory facilities and techniques, maintenance programs, and comparative evaluation of unit process efficiencies.

Category A operator enrollees will be enrolled in training courses wherever feasible. Such courses will be generally taught by operator/instructors trained under or engaged in training under Element II of this project. Such concurrent training will permit the use of the "normal classroom situation" as an inherent part of the instructor development Element.

In addition to formal classroom training, Category A operators will receive specific hands-on training and assistance under the tutelage of experienced operators or similarly qualified individuals. Assistance will also be rendered in relationship to specific problems experienced by the operator in the operation and maintenance of his facility. He will be encouraged and assisted in establishing an active maintenance program for his facility. He will be encouraged to seek certification as a means of evidencing his technical competency as a wastewater treatment facility operator. Wherever practical and feasible, his immediate supervisor and/or the supportive personnel associated with the wastewater treatment facility will be encouraged to interact and participate within the program framework. Heavy emphasis will be placed on developing operator and owner pride and sense of accomplishment in the wastewater treatment facility operation and maintenance. Mechanisms for continuing operator recognition will be encouraged.

Within Category B approximately 100 operators from plants with minor operation deficiencies will be selected during the 24 month project for short-term, limited vis-a-vis instruction and assistance regarding specific problems or difficulties in operation and maintenance. Most operators so selected will have a general knowledge of wastewater treatment facility operation. However, where it appears that general knowledge of wastewater treatment facility operation and maintenance is inadequate or lacking, the operator will be encouraged to enroll in a regular institutional training program. It is the intent of this category, then, to provide selected operators with assistance and solutions to specific treatment phase or unit problems.

Although all operators of wastewater treatment facilities will have access to operator assistance by general field staff of the Illinois Environmental Protection Agency, such assistance is limited to an average of approximately 6 man-hours per plant per year. The 100 selected facilities under

Category B will be offered intensive assistance averaging approximately 3 man-days per plant through the use of full time or contractually retained experienced operators and similarly qualified individuals. The assistance provided to Category B operators will, in general, be of the nature and extent requiring time and knowledge beyond the ken of general field staff. Where appropriate and feasible, field staff will accompany and assist vis-a-vis instructors as a step toward enhancing field operation activities of the Field Operations Section of the Agency.

Element IV (Ninety percent complete)

Centralized Instructor Aids: To develop an inventory of training aids as an adjunct to improved operator training techniques.

To the degree possible, a centralized inventory and repository of instructor aids should be developed. This will include cataloging available loan or rental materials from various pertinent informational sources, particularly in Illinois. A portion of this work has already been accomplished. Charles County Community College in La Plata, Maryland has published a list under the title, Instructional Materials Available. In addition, the Operator Certification and Training Unit of the Field Operations Section, Division of Water Pollution Control, along with a group of interested operator/instructors has commenced compilation of a similar list of materials in Illinois. Certain instructor aids are readily available and used with sufficient frequency to warrant procurement by individual educational institutions. It is not the intent of this Element to stockpile or unnecessarily accumulate training materials, or to restrict their accessibility. However, due to their relatively high cost, accumulating such materials can only be justified by maximizing utility among several educational institutions. Examples may be demonstration or working models of unit processes, movies, and video-tape presentations. In some instances, manufacturers and research organizations are willing to make such materials available for training at little or no cost to training components. To the extent possible, funds should be made available for the purchase and transport of such materials. Where the expenditure for a single item exceeds $100 in total amount, prior approval of the funding agency will be sought prior to commitment.

As pointed out before, this element does not intend to accumulate a large inventory of specialized training material, but rather to: a) develop a catalog system of such materials, and to provide the mechanism for their inter-loan among instructors; and, b) where practical and feasible, to inventory and make available such training aids as may not otherwise be practically available.

Element V (Evaluation)

Program Evaluation: To evaluate the activities of Elements I through IV and determine whether or not a significant improvement in wastewater treatment facility operation and maintenance has transpired.

This Element will consist of two phases. Phase I evaluation: a) pre-evaluation to establish base-line data for reference to Elements II, and III; b) continuing evaluation to monitor the progress of the program in Elements I, II, III; and, c) post-evaluation to determine program achievement in Elements I, II, III; and the Phase II project report. The purpose of the project report is to draw relevant conclusions, in terms of efficiency, benefits, and accomplishments, from the Program for Optimum Operation Practices. Evaluation personnel will make recommendations as to the termination or continuance of various Elements under general Illinois EPA or federal budgetary provisions.

In 1976, sixty-eight courses in wastewater treatment procedures were offered through community colleges in twenty-four locations. The average class size was twenty students; although many persons were enrolled in more than one course. IEPA personnel taught several of the courses and trained instructors simultaneously.

Advanced training techniques have continued to receive high priority in IEPA training courses. IEPA staff feel the efforts have been most effective.

The Water Pollution Control Division of IEPA conducted thirty-three seminars and workshops in 1976. The one and two-day sessions conducted throughout the state included programs in management awareness, health and safety, equipment operation, maintenance, mathematics, treatment techniques, and informative sessions for municipal officials.

The most significant development in training wastewater operators in Illinois has been the completion of the Environmental Resources Training Center (ERTC) at the Southern Illinois University, Edwardsville campus, at a cost of more than two million dollars, all from state funds.

ERTC is a unique facility which includes classrooms, laboratories and a wastewater treatment plant. The first classes began in January, 1977.

The program goals for ERTC are as follows:

1) To teach direct training courses at the Edwardsville site. Entry level and advanced courses and seminars will be offered;

2) To develop a cooperating network of community colleges which offer pollution control operator training courses to encourage consistency and transferability of coursework;

3) To offer instructor development training courses;

4) To develop training aids and course curricula and to maintain a library of training materials which can be loaned to a community college or treatment plant for use in training courses;

5) To conduct applied research related to operation and maintenance of pollution control equipment and processes.

E. Career Potential

As no growth can be considered likely in the public sector (specifically, the IEPA Division of Water Pollution Control) due to budgetary constraints, career opportunities will be extremely limited. In some instances even turnover may not be replaced due to the job freeze now in effect for state agencies.

Opportunities in the private sector will be fairly substantial; primarily due to more stringent enforcement of existing state and federal regulations. Certified wastewater treatment operators are expected to increase at a rate of 9 percent per annum. The bulk of the openings will occur at the entry level (Classification VII). There will be some expansion in opportunities for administrative, labor and maintenance personnel, but these positions will not increase at a rate comensurate with the rate of growth for certified operators because the certified operators increase includes a substantial number of persons already working but not yet certified.

F. Conclusion

Wastewater treatment plant operator training and certification efforts have continued to be of major concern to the IEPA Division of Water Pollution Control. Specific evidence of the effects of this emphasis include the reclassification of operator certificates, implementation of the plan for improved training developed in 1974, the completion of the ERTC facility at Edwardsville, and the substantial increase in the number of operators holding active certificates.

These activities in training development will have a substantial effect on the quality of wastewater treatment in Illinois. The operator component of the workforce will witness a marked increase in the next five years. Training for such persons will be available and will be of high quality.

VIII. ENERGY

A. Introduction

Illinois holds a prominent position, nationally, in two significant aspects of energy considerations for the future: coal and nuclear power generation.

Coal was discovered in Illinois in 1673, by Joliet and Marquette. Two centuries later (1877) James MacFarlane, in Coal Regions of America, summarized the situation regarding coal in Illinois which is applicable today, "The valuable features of Illinois coal are that there is plenty of it, that it is widely distributed over the State...and, poor as the coal is, there is a large market for it, for want of better."

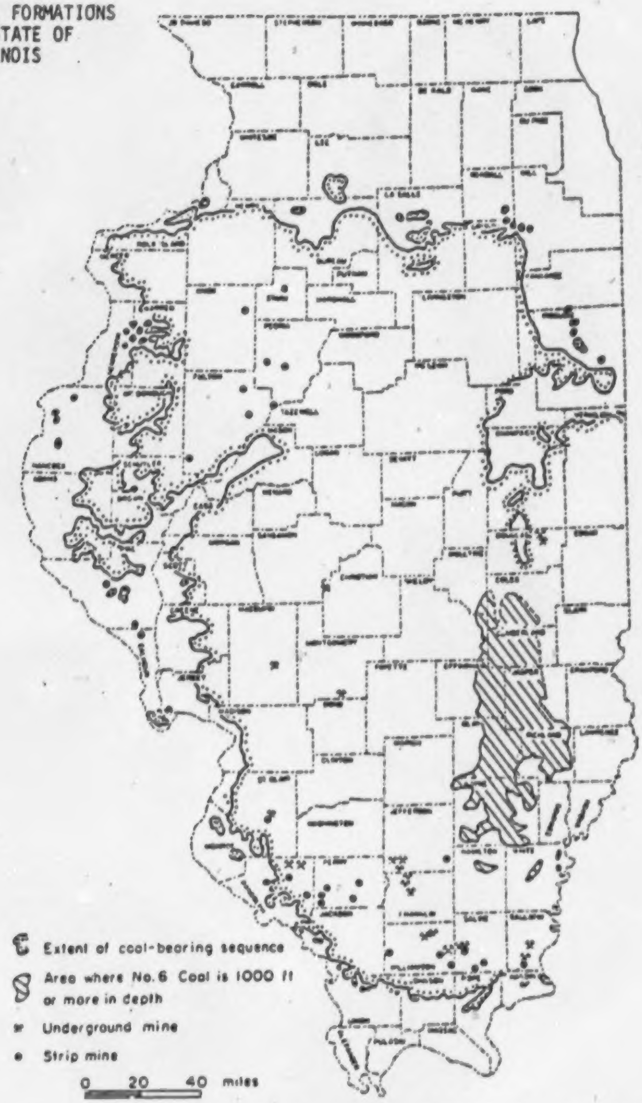
Coal formations underlie 65% of the state (36,806 square miles, see Figure 12). Illinois has the largest reserves of bituminous coal in the country. North Dakota and Montana have larger reserves but much of it is sub-bituminous coal or lignite. Total Illinois reserves are estimated at 161 billion tons. Recoverable reserves (those presently economically and technologically feasible to extract) are estimated at 65 billion tons.

Illinois ranks fourth among the states in coal production. For more than ten years, the annual production has fluctuated between 55 and 65 million tons. In 1975, 59,530,476 tons were extracted.

Production and employment have varied considerably in Illinois' coal industry. Both peaked in the early 1920's. In 1923, there were 99,081 persons employed in mining coal. Production increased during World War II; employment had a slight respite from its steady decline. Production's

Figure 12

COAL FORMATIONS
IN STATE OF
ILLINOIS


Extent of coal-bearing sequence
Area where No. 6 Coal is 1000 ft or more in depth
Underground mine
Strip mine
0 20 40 miles

Operating coal mines as of October 1973. (Source: Illinois Department of Mines and Minerals.)

post-war low came in 1954, when only 40,000,000 tons were mined; employment, in response to technological innovations, continued to decline to a low of 8,054 in 1967 (see Figure 13).

During this period, the trend was to fewer, larger mines. In 1920, there were 373 mines operating; in 1968, only 48. Concurrently, the proportion produced by strip mine operation was only .005% of the total coal extraction of 1920; strip mined coal accounted for 58% of 1967's production.

Statistics from 1969 through 1974 are not comparable with prior years as several small local strip mines were added to the data base which had not been included in previous reports. Essentially, production remained fairly steady; employment rose somewhat.

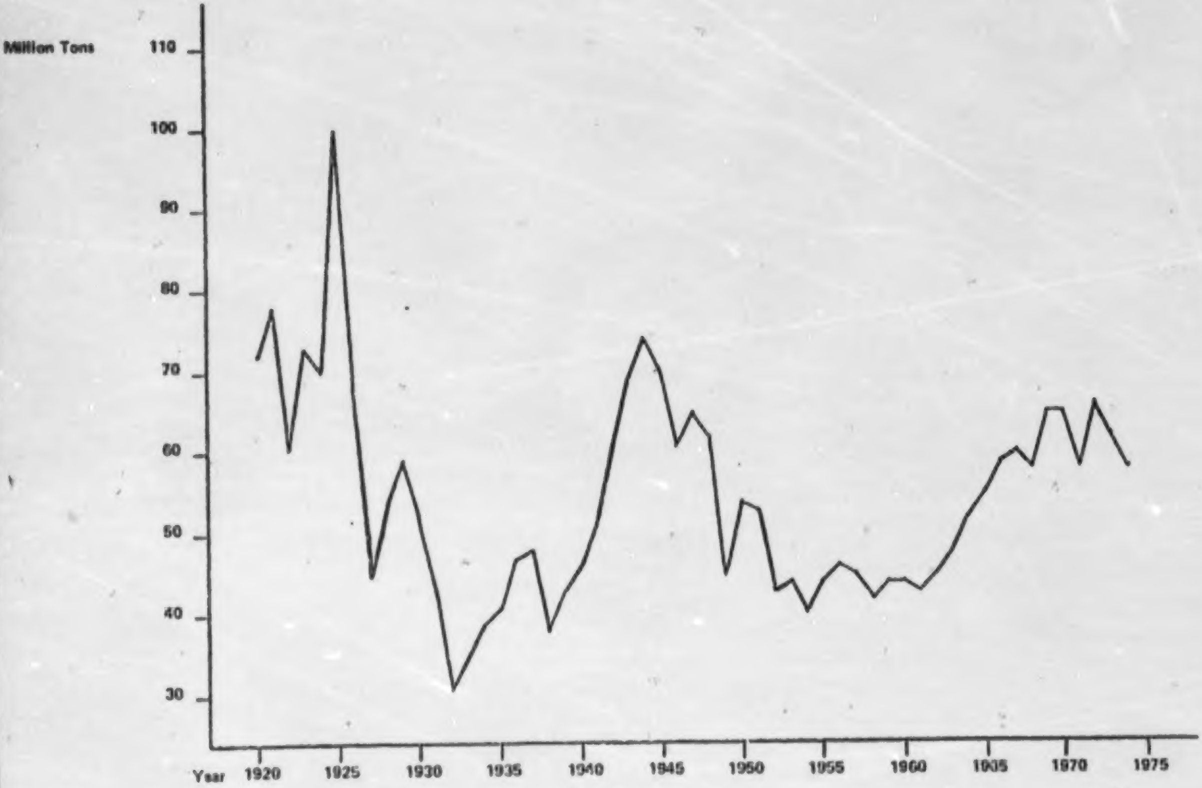
By 1974, there were 55 mines; 23 underground, 32 strip mines. In 1975, miners had increased to 13,623.

Thirteen major new mines are being constructed; all are expected to be operating at full production rates by 1982. They include one slope, four strip, and eight deep mines. The annual production of these new mines is expected to be 27 million tons. Several smaller strip mines have also begun operation since 1974. If the Tennessee Valley Authority exercises its option to purchase 300 million tons of coal in a 23,360 acre tract, another mine will be opened.

Figure 14 presents a profile of past and projected energy consumption in Illinois.

Illinois consumes 9% of the coal extracted in the United States. It ranks third in consumption, behind Ohio and Pennsylvania. Electrical power generation accounts for 80% of Illinois' consumption. Table XXII depicts

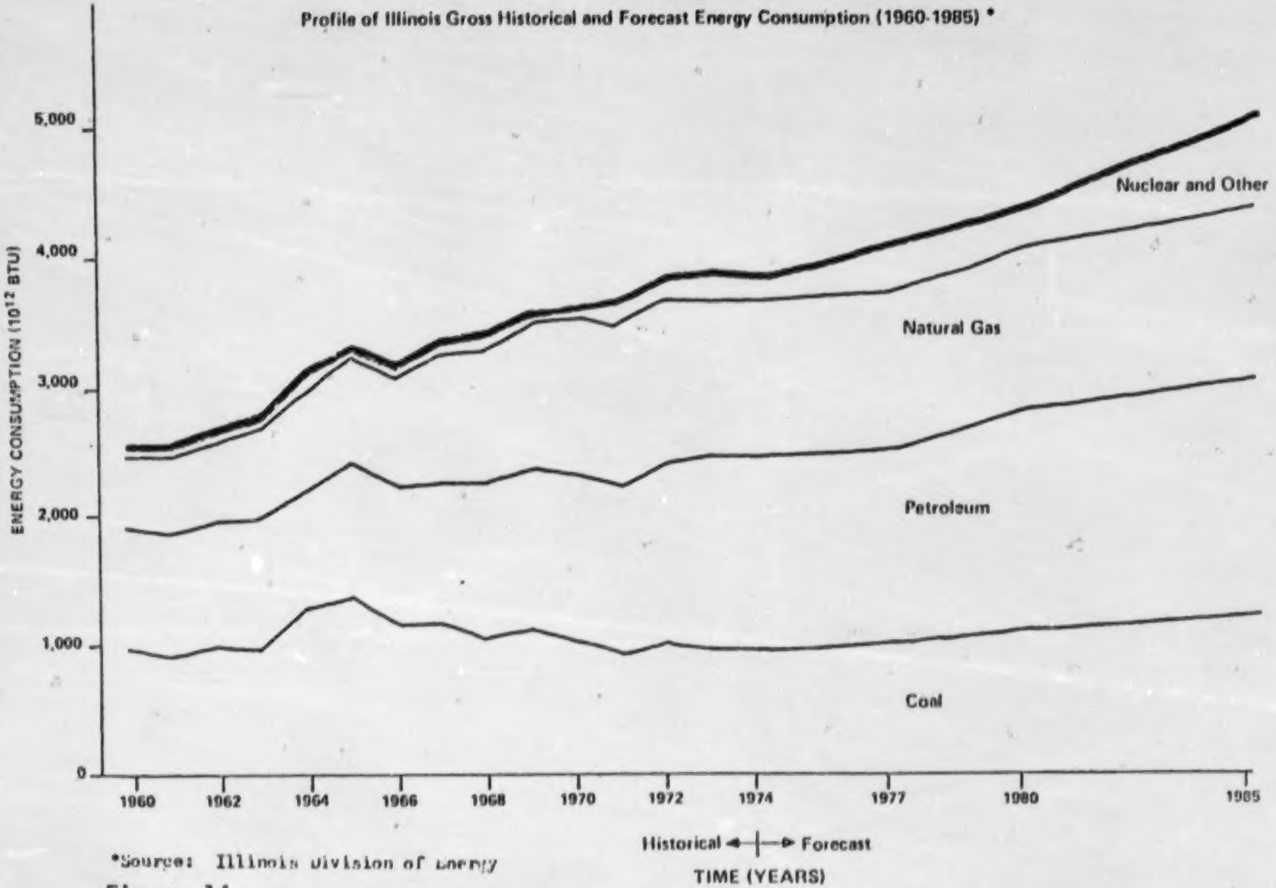
ILLINOIS COAL PRODUCTION *
1920-1974



Data Source: "1974 Annual Coal, Oil and Gas Report", Illinois Department of Mines and Minerals.

*Source: Illinois Division of Energy

Figure 13.



*Source: Illinois Division of Energy

Figure 14.

the flow of bituminous coal as it is produced, exported, imported, and used in Illinois.

TABLE XXII

ILLINOIS BITUMINOUS COAL FLOW, 1974
(in tons)

Produced	Exported	Imported	Used
58,073,000	32,719,000	13,700,000	39,054,000

SOURCE: U.S. Bureau of Mines

Table XXIII presents the distribution of the consumption of coal in Illinois.

TABLE XXIII

COAL CONSUMPTION IN ILLINOIS, 1974
(in tons)

Use	Amount
Utilities	30,837,000
Coke and Gas Plants	3,100,000
Residential and Commercial	772,000
Industrial and Other	4,345,000
TOTAL	39,054,000

SOURCE: U.S. Bureau of Mines

The high sulfur content of Illinois coal was recognized to reduce its quality long ago. It is unsatisfactory for the production of coke except when mixed with Pennsylvanian coal.[1] The sulfur greatly jeopardized the marketability of Illinois coal for use in electric power generation (the lion's share of coal use) as air pollution standards established across the country in the last decade set limits for sulfur dioxide (SO_2) emissions which could not be met when burning Illinois coal unless capital intensive pollution control equipment was installed.

The effects of air pollution legislation are dramatized by changes in the source of coal burned in Illinois power plants. In 1970, only 3.7% of the coal used by the utilities was imported. In 1974, 24.5% of the coal used to generate electricity in Illinois was low sulfur Western Coal.

In 1974, Illinois embarked upon a comprehensive coal and energy development program. A primary objective was and remains to promote the production and use of Illinois coal. The Illinois Coal Development Bond Act of 1974 provides $70 million for, "research, development, and demonstration of improved methods of discovery, production, transportation, sale, distribution, conversion, end use and waste disposal of coal resources."

The Department of Business and Economic Development (BED), Division of Energy (DOE) has received $10 million (Fiscal Year 1978) for administering the bonding authority (DOE activities are discussed below).

The Illinois Coal Development Bond Act (Public Act 78-1122) established the Illinois Energy Advisory Council on Coal Development. The council is chaired by the governor; the members are the directors of seven cabinet departments. It is empowered to:

1) solicit, accept, and expend funds from any source, including the federal government;

2) make contractual arrangements with business, industry, government, and universities to promote development of coal resources, and to contract "for planning, design, acquisition, development, construction, improvement, and financing a site or sites and facilities for establishing plants, projects, or demonstrations for development of coal resources";

3) acquire property by exercise of the power of eminent domain.

Several schemes have been set forth which combine state, federal and industry monies in variety of coal development and conversion research and demonstration projects and facilities.

One facility has been operating for several years. The HYGAS Pilot plant, Stickney, Illinois, is operated by the Institute of Gas Technology of the Illinois Institute of Technology. The plant produces pipeline gas from coal by hydrogasification.

The State has committed $25 million from Coal Development Bond monies for development of a federally-supported coal conversion plant to be located in New Athens. The plant will be operated by the Coalcon Corporation, a joint venture of Union Carbide and Chemical Construction Co., a unit of General Tire's Aerojet-General Corporation. The Coalcon project, not yet scheduled for construction, will be a Medium Btu Coal Gasification Liquification demonstration plant. It could become one module of a commercial operation.

The Illinois Coal Gasification Group, a consortium of five Illinois Utilities, is awaiting an engineering and feasibility study from the Energy Research Development and Administration (ERDA) for a High Btu Gasification plant in Perry County near Percy, Illinois.

Commonwealth Edison has planned a Combined Cycle Low Btu Coal Gasification plant (the Powerton Project) to be located at the Powerton Electric Generating Station, Pekin, Illinois. Construction may begin by the fall of 1977. Current estimates indicate the plant will be on line by September, 1979. It is a test facility and will employ 100-120 people.

Although the state has placed a high priority upon the attraction and support of coal conversion facilities, this is not considered by many to be an ideal solution to the Illinois high-sulfur coal problem for several reasons.

A commercial gasification plant would process about 6 million tons of coal per year. This represents approximately 10% of the state's current annual coal production. To meet this increased demand, more new mines, with a resultant loss to agriculture land, will have to be developed.

Of further concern is the effect on the water resources of the state. Estimates for water usage of such a plant range from an extreme low of 6 million gallons a day for a plant which exercises severe water conservation methods to an extremely high daily usage of as much as 72 million gallons. Ten million gallons a day is estimated to be needed for a standard size plant. In addition to the effect on the water supply, agricultural land may be lost if reserviors must be constructed.

One further drawback is that, with current technology, gasification and liquifaction processes are only 60 to 70% effective; thus 30 to 40% of the coal's original energy value is lost in the conversion process, an additional energy loss which must be added to that of the energy required to effect the conversion.

The conversion facilities are attempts to find solutions to problems with Illinois coal (primarily SO_2 emissions) at the consumption end. There are other problems associated with Illinois coal which arise at the extraction end of the coal industry. Illinois coal lies under agricultural land which is unquestionably ranked among the world's best. In short, extraction of Illinois coal leads to the question of coal or corn, fuel or food.

Some subsidence problems due to deep mines have occurred, but the major concerns stem from the increasing strip mine operations.

Since the first strip mine opened near Danville in 1866, more than 181,000 acres have been stripmined. 103,000 acres were stripped before Illinois's first, weak, reclamation legislation became effective in 1962. Most of this "abandoned" land has not be reclaimed; much of it remains in as poor condition as can be found anywhere.

The original reclamation law required a permit for operating a surface mine with an overburden of more than ten feet, and was administered by the Department of Conservation. In 1968, the law was amended to strengthen reclamation requirements.

The Surface-Mined Land Conservation and Reclamation Act of 1971, requires approval of a reclamation plan before a permit may be issued and stipulates that all mining reclamation must meet the requirements of the Illinois Environmental Protection Act. The law is administered by the Department of Mines and Minerals. It was amended in 1975 to allow more opportunity for local review of reclamation plans and to include more comprehensive requirements to improve restoration of the top layers of agriculturally productive soils. The effectiveness varies with the enforcement practices.

Virtually 100% of all land affected by strip mine operations since 1962 has been under permit. It has either been reclaimed or remains under bond pending reclamation. A company can be denied future permits for noncompliance with reclamation laws. The Land Reclamation Division of the Department of Mines and Minerals controls permits.

The Abandoned Mined Land Reclamation Council was established in 1975 to undertake special reclamation projects for lands mined prior to the 1962 surface mine reclamation laws. The council (seven department heads, chaired by the lieutenant governor) has designated three sites for reclamation projects.

Technological advances have now made it economically feasible to strip land in which the coal is 200 feet below the surface. Strip operations can extract nearly 100% of the coal in a seam; deep mines only about 55%. Approximately one-half the workforce needed for a deep mine is all that is needed to extract an equivalent amount of coal from a surface mine.

Illinois coal production from strip mines is expected to continue to increase despite rising concern as to its effect on agricultural productivity.

The first nuclear reactor in Illinois built to generate commercial electrical power becan operating at Dresden in 1960. Commonweath Edison now operates seven reactors at three generating stations. Eight more reactors (at four sites) are scheduled for completion during the early 1980's. As many as 1400 people may be added to the workforce when the plants go on line. Another station is planned, but contracts have not been let (See Figure 15).

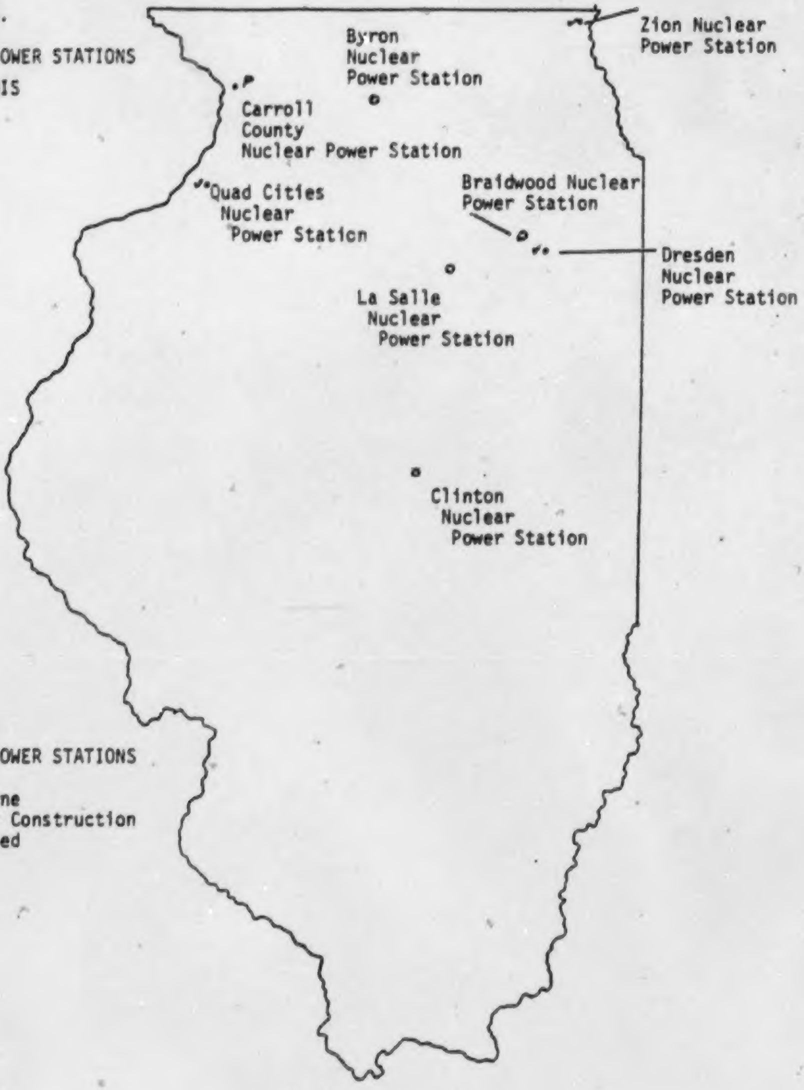
In 1975, 40% of the electricity generated by Commonwealth Edison (serving the Chicago and northern Illinois area) was generated from nuclear sources. This amounted to 25% of the electrical power generated in Illinois in 1975, and is far above the national average.

Energy is a pervasive, nebulous area. This is reflected by the numerous agencies, departments, and commissions throughout Illinois government whose responsibilities include matters which are energy related. There are three governmental entities whose primary responsibility is energy.

The Energy Coordinating Council, an executive council established under the Coal Development Act of 1974, was discussed above.

Figure 15.

NUCLEAR POWER STATIONS IN ILLINOIS


Zion Nuclear Power Station
Byron Nuclear Power Station
Carroll County Nuclear Power Station
Quad Cities Nuclear Power Station
Braidwood Nuclear Power Station
Dresden Nuclear Power Station
La Salle Nuclear Power Station
Clinton Nuclear Power Station

NUCLEAR POWER STATIONS

✓• On Line
o Under Construction
.P Planned

The Division of Energy (DOE) is currently part of the Department of Business and Economic Development (BED). DOE began as the Office of the Fuel and Energy Coordinator during the energy crisis brought on by the Arab oil embargo. Fuel allocation was the original responsibility. As the governor added responsibilities the Office was given divisional status within BED. Its current staffing level is 27.

DOE activities are hampered because much of what it does is not based on any legislated mandate. This continues to cause difficulties as it tries to interact with other state government offices.

In addition to fuel allocation, DOE activities include:

1) Attempts to coordinate state in-house conservation efforts in building operations and maintenance;

2) Development of a state energy conservation plan as required under the federal Energy Policy and Conservation Act of 1975. (A feasibility report has been completed.);

3) Encouragement of alternative energy (especially solar) research and development;

4) Collection and analysis of data on supply and demand for all energy sources;

5) Provision of economic impact statements and economic reviews of coal development projects;

6) Monitoring and provision of analyses of federal energy legislation.

The Illinois Energy Resources Commission (IERC) is a legislative commission established in 1975. It has eight legislative and ten public members. The permanent staff of three has been temporarily expanded to eleven.

The commission is mandated to, "study, review and make recommendations on the administrative structure the state should adopt for the efficient management of the state's effort in finding solutions to energy-related problems."

The enabling act also stipulates the IERC shall:

1) Coordinate energy policy long-range programs;

2) Coordinate the agency structure;

3) Promote coal development projects (IERC has the authority for approval of all expenditures of Coal Development Bond funds);

4) Accept energy grants; and

5) Disseminate energy information.

The temporarily expanded staff has been heavily involved in planning for the future of Illinois' governmental organization for energy matters. The IERC staff has been developing draft legislation to be brought before the legislature in the spring of 1977. The legislation package includes:

1) Numerous amendments to the School Code to promote energy education and energy conservation in school facilities;

2) Amendments to the Board of High Education Act based on recommendations of the 1975 environmental/energy education and workforce study;

3) A home insulation and financing act;

4) An act prohibiting the use of certain decorative lighting gas lamps;

5) An energy efficiency labeling act;

6) Acts pertaining to solar rights and easements; and

7) A variety of other energy related acts which cover a broad spectrum.

The IERC staff has made a study of energy-related state governmental bodies. The findings and options for reorganization have been presented to the Commission in a booklet titled, "Illinois Energy Reorganization Options." In this publication problem areas of overlapping or conflicting jurisdiction in energy matters are identified and discussed and recommendations for improvement are made.

Four major options for reorganization of energy-related entities are presented in the booklet. Option I is the creation of a new state energy out of the existing Division of Energy, Department of Business and Economic Development. Option II is the creation of a Department of Natural Resources. It is similar to Option I, but would also consolidate existing energy and natural resources state bodies into one umbrella unit. Option III is the establishment of a small clearinghouse energy office, titled Central Energy Office. It would operate under the governor out of the Division of Energy to coordinate state action in relation to federal energy programs, especially grant programs. Option IV is the creation of an Energy, Environment and Natural Resources Commission. Rather than an executive energy agency as are the first three options, this would be an independent regulatory commission. Figures 16 through 19 illustrate the options.

Portions of the four options may be recombined, thus creating further options. There is little indication at this time as to which, if any, of the above will be acted upon by the legislature. The future of state organization for energy matters remains uncertain.

Extensive research continues to be conducted in the state's public and private universities in energy conversion, energy conservation and in alternative energy technology.

Argonne National Laboratory (ANL) is one of the nation's largest federally funded research and development laboratories. The facilities are owned by the federal government; the University of Chicago operates the laboratories for the Energy Research and Development Administration (ERDA) under a tripartite contract among ERDA, the University of Chicago, and the Argonne Universities Association (a group of 30 midwestern universities).

OPTION 1*

Comprehensive Energy Act Agency

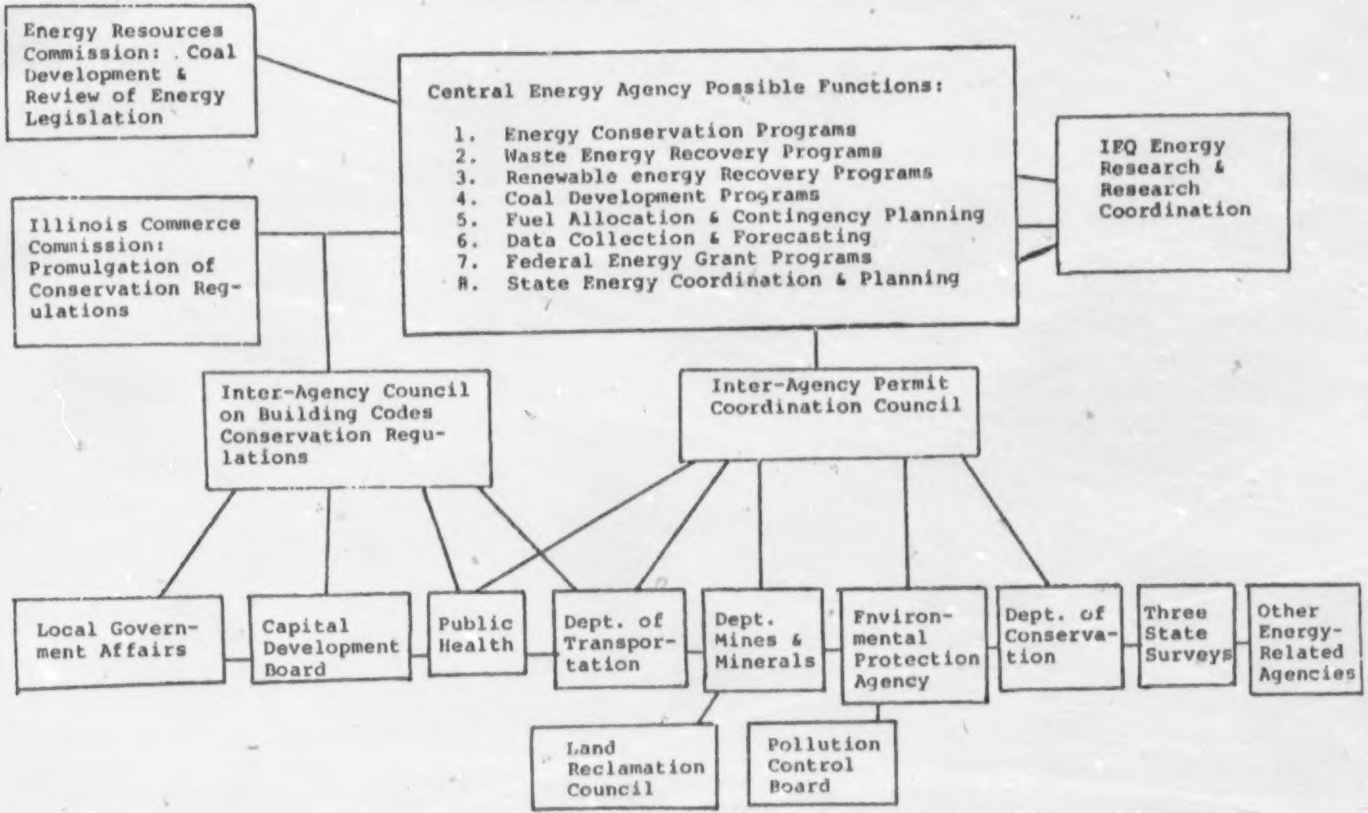
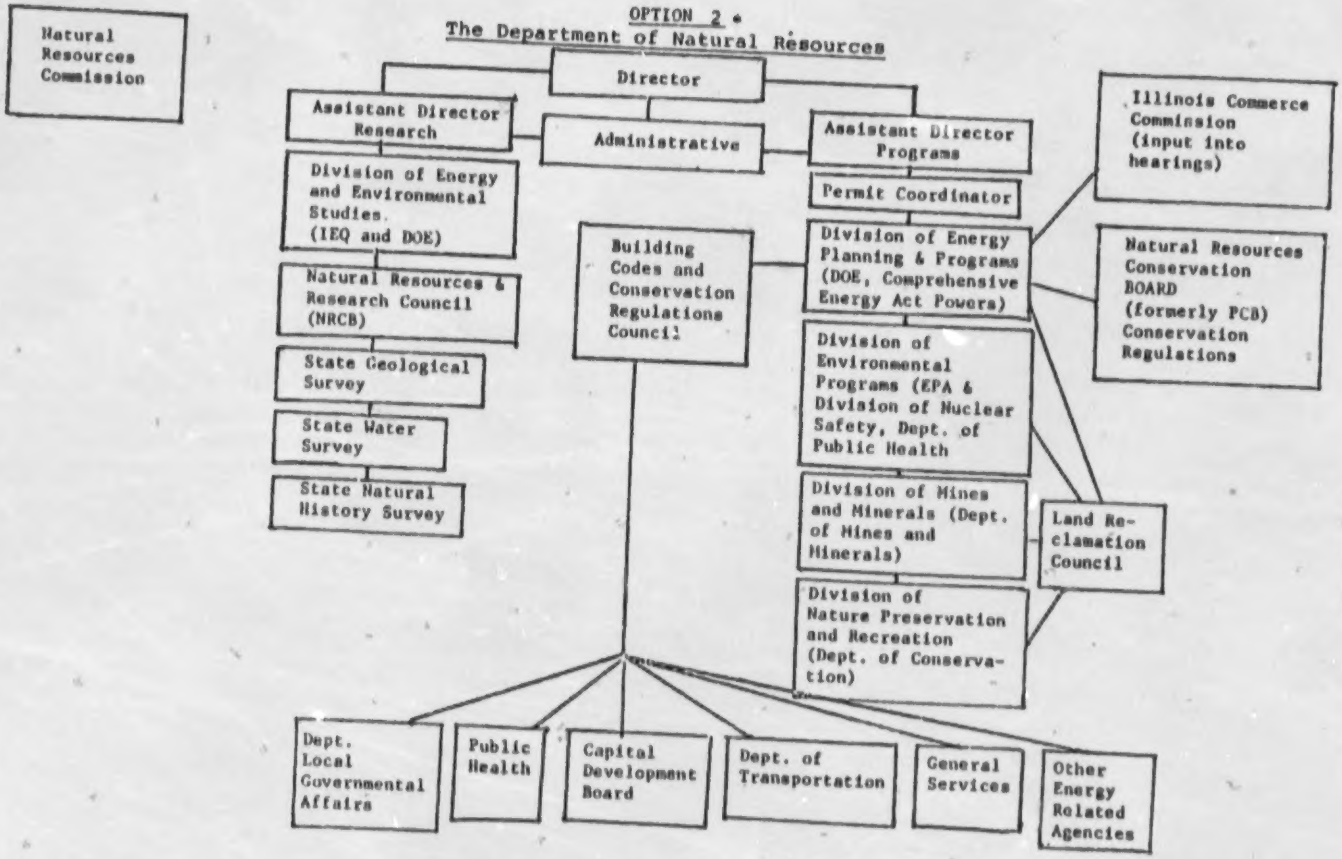

Energy Resources Commission: Coal Development & Review of Energy Legislation
Central Energy Agency Possible Functions:
1. Energy Conservation Programs
2. Waste Energy Recovery Programs
3. Renewable energy Recovery Programs
4. Coal Development Programs
5. Fuel Allocation & Contingency Planning
6. Data Collection & Forecasting
7. Federal Energy Grant Programs
8. State Energy Coordination & Planning
IEQ Energy Research & Research Coordination
Illinois Commerce Commission: Promulgation of Conservation Regulations
Inter-Agency Council on Building Codes Conservation Regulations
Inter-Agency Permit Coordination Council
Local Government Affairs
Capital Development Board
Public Health
Dept. of Transportation
Dept. Mines & Minerals
Environmental Protection Agency
Dept. of Conservation
Three State Surveys
Other Energy-Related Agencies
Land Reclamation Council
Pollution Control Board

Figure 16

ALL AGENCIES SUBJECT TO IN-HOUSE CONSERVATION PROGRAM, INFORMAL COORDINATION ON ENERGY MATTERS OF ENERGY AGENCY.

*Source: Illinois Energy Resources Commission


Natural Resources Commission
Director
Assistant Director Research
Administrative
Assistant Director Programs
Division of Energy and Environmental Studies. (IEQ and DOE)
Natural Resources & Research Council (NRCB)
State Geological Survey
State Water Survey
State Natural History Survey
Building Codes and Conservation Regulations Council
Permit Coordinator
Division of Energy Planning & Programs (DOE, Comprehensive Energy Act Powers)
Division of Environmental Programs (EPA & Division of Nuclear Safety, Dept. of Public Health
Division of Mines and Minerals (Dept. of Mines and Minerals)
Division of Nature Preservation and Recreation (Dept. of Conservation)
Illinois Commerce Commission (input into hearings)
Natural Resources Conservation BOARD (formerly PCB) Conservation Regulations
Land Reclamation Council
Dept. Local Governmental Affairs
Public Health
Capital Development Board
Dept. of Transportation
General Services
Other Energy Related Agencies

OPTION 2*
The Department of Natural Resources

THE DEPARTMENT WOULD COORDINATE STATE IN-HOUSE CONSERVATION AND OTHER ENERGY-RELATED PROGRAMS.
*Source: Illinois Energy Resources Commission

Figure 17

OPTION 3 *

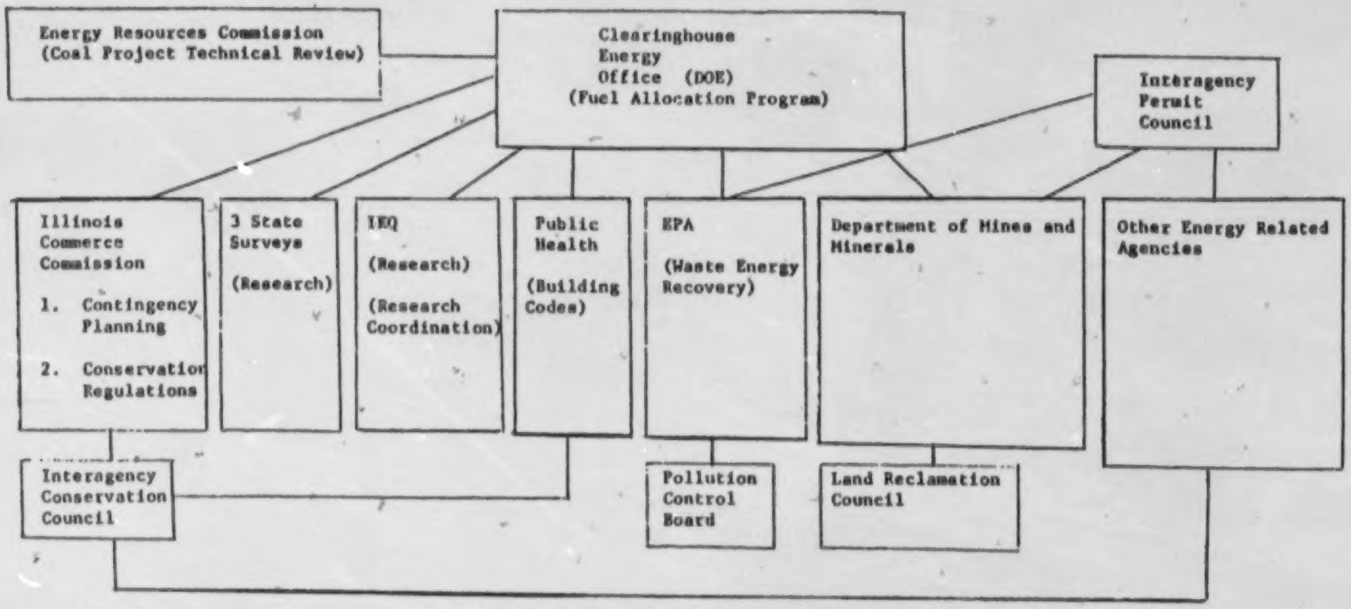

Energy Resources Commission (Coal Project Technical Review)
Clearinghouse Energy Office (DOE) (Fuel Allocation Program)
Interagency Permit Council
Illinois Commerce Commission
1. Contingency Planning
2. Conservation Regulations
3 State Surveys (Research)
IEQ (Research) (Research Coordination)
Public Health (Building Codes)
EPA (Waste Energy Recovery)
Department of Mines and Minerals
Other Energy Related Agencies
Interagency Conservation Council
Pollution Control Board
Land Reclamation Council

Figure 18

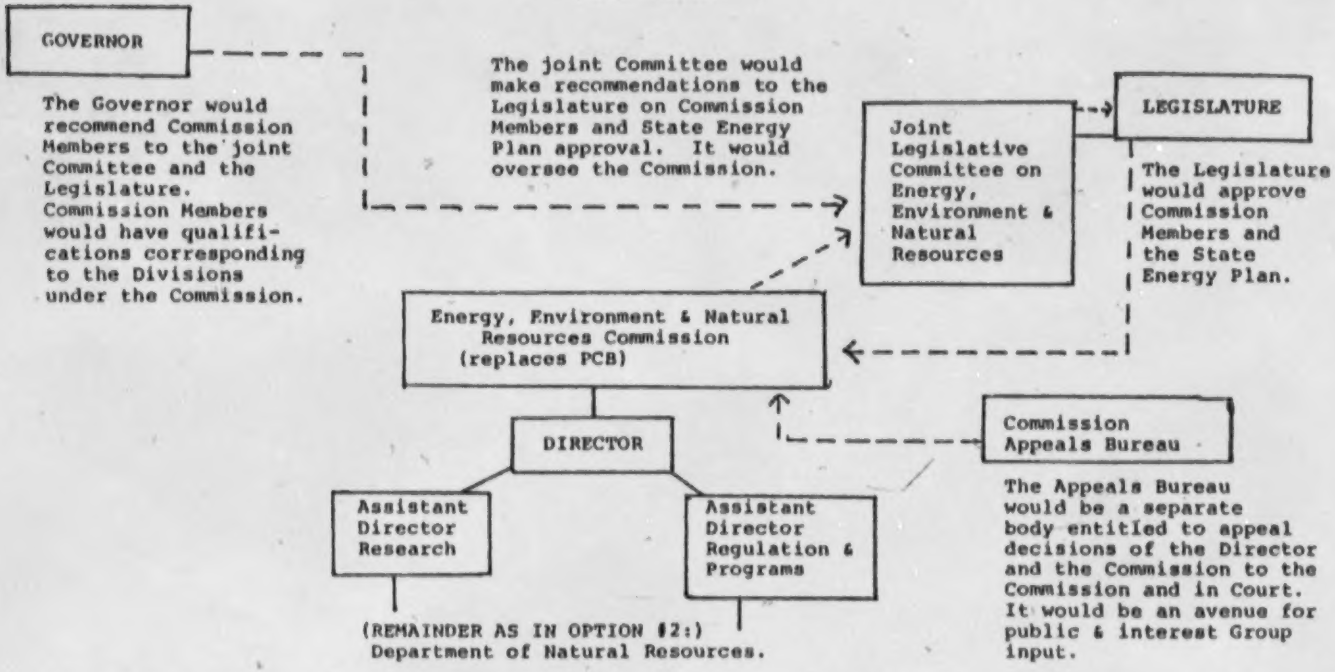
THE ENERGY OFFICE WOULD COORDINATE STATE ACTION ON FEDERAL ENERGY PROGRAMS AND PROJECTS, AND SERVE AS A CLEARINGHOUSE FOR ENERGY INFORMATION AND ACTIVITIES.

IT WOULD NOT ADMINISTER MAJOR ENERGY PROGRAMS.

*Source: Illinois Energy Resources Commission

OPTION 4*

Illinois Energy, Environment & Natural Resources Commission


GOVERNOR
LEGISLATURE
Joint Legislative Committee on Energy, Environment & Natural Resources
Energy, Environment & Natural Resources Commission (replaces PCB)
Commission Appeals Bureau
DIRECTOR
Assistant Director Research
Assistant Director Regulation & Programs
(REMAINDER AS IN OPTION #2:) Department of Natural Resources.

The Governor would recommend Commission Members to the joint Committee and the Legislature. Commission Members would have qualifications corresponding to the Divisions under the Commission.

The joint Committee would make recommendations to the Legislature on Commission Members and State Energy Plan approval. It would oversee the Commission.

The Legislature would approve Commission Members and the State Energy Plan.

The Appeals Bureau would be a separate body entitled to appeal decisions of the Director and the Commission to the Commission and in Court. It would be an avenue for public & interest Group input.

Figure 19

1. The Commission would set final policy decisions, adopt regulations and hear cases arising under regulations. The Pollution Control Board would be abolished.

2. The Director would be appointed by the Commission or be a Commission Member.

3. The Commission would prepare a State Energy Plan for adoption by the Legislature.

*Source: Illinois Energy Resources Commission

Most Argonne activities are funded by ERDA, but many projects are supported by local, state and other federal agencies. The operating budget for FY 1976 was nearly $148 million.

Argonne is located on a wooded 1,700 acre site, 27 miles southwest of downtown Chicago. It began as the Metallurgical Laboratory at the University of Chicago, established in early 1942, as a part of the Manhattan Project. Later that year, Enrico Fermi directed the experiment that led to the first controlled nuclear chain reaction.

With the succession of ERDA and its assumption of authority formerly relegated to the Atmoic Energy Commission, Argonne has had an expanding role in energy research. Much of ANL's reactor research, including work on the liquid metal fast breeder reactor (LMFBR) is conducted at Argonne-West in Idaho.

Argonne energy research and development activities include high performance battery testing, magnetohydrodynamic (MHD) generator research, experiments with solar energy devices, and an extensive coal technology program. Energy conservation, storage, and conversion studies are being conducted as are studies of the impacts of energy-related pollutants on man and ecosystems. Technologies for controlling such pollution are being developed and tested.

ANL's Energy and Environmental Systems Division (EES) is an interdisciplinary team of engineers and natural and social scientists. It specializes in mission-oriented applied research, systems analysis and policy evaluation.

The Division's activities include:

1) Atmospheric Science;

2) Coal Extraction and Land Reclamation;

3) Energy conservation;

4) Energy and Environmental Technology;
5) Regulatory Studies;
6) Resource Management;
7) Systems Analysis, Technology Assessment and Policy Evaluation;
8) Water Resources.

B. Workforce Profile

Data for this and other sections were gathered through on-site interviews. Of particular assistance were Mr. Sheridan Glen, Mr. J. Ernest Dunwoody, and Mr. Bruce Green, of the Division of Energy; Mr. Donald Handy, of the Illinois Energy Resources Commission; Mr. J. D. Grady, Manager, Westinghouse Training Center, Zion, Illinois. Several people at Argonne National Laboratory, Mr. Art Vervack, Ms. Pat Failla, Mr. Tom Baldwin, and Dr. Shelby Miller among them, were most helpful as were numerous others in a variety of capacities.

The Division of Energy currently employs 27 persons, seven of whom are in clerical positions. Staffing at DOE is fluid. At the present, there are three persons involved in fuel allocation, two in coal development, three in program development, and twelve (four of them contractual) in energy conservation and alternative energy.

The Illinois Energy Resource Commission temporary staffing level of eleven includes the director, five clerical people, a loaned executive from NASA to work and advise on the engineering and technical aspects of the Commission's effots, an economist and a consultant to draft proposed energy legislation, a staff attorney under a contractual arrangement, and an individual to coordinate the Commission's Study Panel's activities and reports.

The Land Reclamation Division of the Department of Mines and Minerals employs eight technical persons educated in agronomy, engineering, chemistry, and related areas. This staffing represents a ratio of about one person for every 20 mining companies in Illinois. Although the workload is heavy, the staffing level is considered adequate, at present.

The Abandoned Mine Land Reclamation Council has a three-person staff.

There are no estimates as to the size of the private sector workforce in energy as it relates to pollution control and abatement. People in the field are reluctant even to surmise as to numbers in reasonably specific categories. Much of the work in this diverse area is but one part of an individual's overall duties and is not easily identifiable in terms of number of people or manhours.

Of the 4,425 Argonne National Laboratory employees, about 1,500 have college degrees, nearly half of them Ph.D.s. Another 380 are technicians. The Energy and Environmental Systems Division (EES) is the fastest growing section of ANL. Currently, there are eighty professionals in EES with degrees in 39 different professional areas including such diverse areas as aerospace engineering, demography, geophysics, mechanical engineering, oceanography, environmental studies, sociology, and urban planning.

There are 60-80 persons employed in radiation control in the nuclear power plants. Public sector workforce staffing for the radiation control portion of the nuclear energy industry are discussed in RADIATION.

Due to increasingly explicit legislation in surface mine reclamation, mining operations have increased the time and number of persons involved in reclamation activities, but there are no available estimates as to how many are so employed.

In October, 1976, DOE published a directory of solar energy-related equipment manufacturers, architects and engineers. Ten Illinois equipment manufacturers and distributors are listed; 18 architects, engineering companies and solar energy consultants are listed. DOE personnel say the publication needs updating; they are sure many companies were missed.

Three publications have listed projects and personnel conducting energy research at the universities in Illinois.

C. Workforce Projections

The future of the public sector workforce in energy is uncertain. If any of the Illinois Energy Resource Commission (IERC) staff options (or a combination, thereof) for the reorganization of energy-related entities in Illinois government are adopted, significant changes in responsibilities and staffing levels could occur as a result of realignment.

Most likely to be affected under any change will be the Division of Energy (DOE). DOE has experienced rapid growth, especially in the Energy Conservation and Alternative Energy Section. Growth in this area is expected to continue. However, due to the uncertainty resulting from conflicting rumors of reorganization there is an understandable reluctance to discuss specific numbers and direction of thrust.

Regardless of the nature of reorganization, there will be a significant increase in the positions with responsibilities in energy conservation and alternative energy in Illinois. What is not known is to which governmental body they will be assigned.

The Illinois Energy Resources Commission staff will be reduced to the director, two secretaries and a technical person at the end of FY 1977. IERC staff has recommended a narrowed mandate for the Commission. Staffing for IERC may fluctuate over the next few years as new responsibilities are added and as updating of IERC materials and efforts are required.

Overall, the public sector workforce is expected to increase as the nation and the state become increasingly energy-conscious. Specific assignment of energy responsibilities and positions as to governmental organization remains uncertain in Illinois.

Workforce projections for the private sector are unavailable. Field sources are certain of substantial growth in research activities, development and dissemination of alternative energy technology (especially solar), mining reclamation, coal development-related pollution control techniques, and energy conservation. Expansion in these areas is well underway and is expected to accelerate rapidly in the next few years.

Argonne National Laboratory anticipates an annual growth rate of about 4 per cent over the next five years. There are no estimates for private sector activities.

D. Training and Certification

In addition to the extensive education and research activities relavant to energy conducted at the public and private universities in Illinois, there are three special facilities which engage in energy-related research and education.

Argonne National Laboratory has a major commitment to education and training programs in conjunction with universities and other schools. Such activities fall into five categories:

1) Research Participation. University students, faculty and post-doctorates usually participate in one research problem under supervision of an ANL scientist or engineer. The research experience may last from eight weeks to one year or as long as three years for thesis students or post-doctorates;

2) Internships. High school and university students may participate in several assignments shorter than those of the first category. The assignments often involve experience other than research;

3) Workshops. Most workshops average about two days, but may last a week. They are usually for university faculty, but may be presented for ERDA or industrial personnel. Workshops often include laboratory exercises or simulated on-the-job experience as well as lectures;

4) Institutes and Courses. These are one to six week learning sessions for faculty or ERDA and other research and development facility personnel. The tutorial experience is reinforced with field observations, demonstrations, or experiments;

5) Conferences. ANL personnel, faculty and graduate students participate in a tutorial experience for two to four days. Conferences often involve visits to ANL project organizations.

In addition to the above, ANL hires temporary employees, often faculty, graduate or undergraduate students, and post-doctorals, who, although they contribute to a research project, also find it to be a learning experience.

Fermilab, at Batavia, Illinois, is a high-energy physics research facility. It has educational and training experience programs for university faculty and students similar to that of Argonne.

The Westinghouse Electric Corporation, Nuclear Service Division, operates a major training facility for nuclear reactor power plant operators at Zion, Illinois. The Westinghouse Training Center, which employs 29 persons, is operated under a joint venture agreement with Commonwealth Edison.

In addition to classroom instruction, trainees operate the simulator (a duplicate of the control room of the Zion nuclear power plant), and train on the Westinghouse Nuclear Training Reactor.

The programs are designed to meet Nuclear Regulatory Commission (NRC) requirements for training of nuclear power plant personnel, including preparation for the Senior Reactor Operator (SRO) and Reactor Operator (RO) licensing.

Training is conducted under a contractual agreement between Westinghouse and utilities with nuclear power plants.

The operator training program consists of three phases: Phase I (11 weeks) includes eight weeks of classroom instruction and three weeks training on the small nuclear training reactor. Phase II (10 weeks) consists of systems training; and Phase III (9 weeks) is training on the simulator.

Under NRC regulations persons must meet certain requalifying requirements every two years to retain an operator's license. Westinghouse has developed and conducts courses which meet these requirements.

Of the twenty-four instructors at the Center, twenty have experience in the U.S. Navy nuclear program. Some state personnel, however, have expressed the opinion that there is an overemphasis on nuclear expertise.

The U.S. Bureau of Mines is establishing a mining research station at a cost of $1.875 million to be located at Carbondale. The station will be the fifth of its kind and the first to be established since the 1950's. It will employ approximately 50 scientists, engineers, and technicians.

Extensive cooperation is planned between the station and the University of Southern Illinois-Carbondale Coal Extraction and Utilization Research Center. The Illinois Board of Higher Education has recommended program support of $150,000 to the center for FY 1978 and $50,000 support for an M.S. in mining engineering program for the same period. However, this funding level may be cut substantially.

E. Career Potential

Career opportunities are expanding now and are expected to continue to increase for several years. Engineers with training in both fluids and thermal will be in special demand. Other engineers, scientists, architects, and social scientists with flexible training capabilities will be needed as changes in our energy system are researched, designed, built, and effect changes in society.

There may well be opportunities for draftsmen and other skilled trades as alternative energy systems are becoming more economically competitive.

The opening of new coal mines, especially strip mines, and the increasingly strict mine reclamation legislation and concern over the loss of agricultural land will precipitate an increase in demand for people with the variety of skills needed for comprehensive reclamation work.

The commitment to development of Illinois coal and the continued commitment to nuclear power in Illinois will insure opportunities for persons with skills appropriate to each of these areas.

F. Conclusion

The public sector workforce is expected to increase in Illinois over the next five years as energy research, planning, conservation, and public education activities expand. There will be positions for engineers, planners, systems analysts, administrators and social scientists.

Illinois' commitment to coal development and nuclear power will continue to keep these areas open to increased employment.

Momentum is increasing in research and development activities in alternative energy sources. Employment opportunities for persons with a broad variety of skills will continue to improve as alternative energy systems become more economically competitive.

Although specific projections cannot be made at the present time, it is anticipated that persons with combined training in fluid and thermal engineering will be in demand. Specific skills which are projected to be in demand over the next few years include the following: 1) basic knowledge of technological skills; 2) managerial and organizational skills; and, 3) public relations skills. Persons with education and skills which can be interfaced with energy in the development and implementation of changes in energy systems, energy policy, and the effects on society will be sought.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

In 1974-75, the Illinois Institute for Environmental Quality and the Illinois Board of Higher Education pooled resources to develop a "Master Plan for Environmental/Energy Higher Education in Illinois". The U.S. Environmental Protection Agency joined in the effort and provided funds to add a workforce study and related curricula recommendations component to the project.

On-site interviews were conducted at twelve of the thirteen state universities. Telephone interviews and extensive correspondence were conducted with private colleges and universities and public community colleges. Personal and telephone interviews were held with numerous persons in the public and private sectors of pollution control activities. Results of the interviews and recommendations for changes in and additions to environmental/energy educational efforts were compiled and published in May, 1975, under the title, "A Work Force for Environment and Energy."

The book includes:

1) Detailed descriptions of ongoing environmental and energy programs at state universities in Illinois;

2) Descriptions of proposed environmental and energy programs at state universities in Illinois;

3) Recommendations for Illinois Board of Higher Education approval of proposed environmental and energy programs;

4) Brief descriptions of environmental and energy educational programs offered in private universities and colleges in Illinois;

5) Synopses of programs and course offerings at Illinois community colleges;

6) Recommendation for initiating and implementing environmental/energy operating plans for the campus of each public university and college in illinois;

7) Recommendation for establishing Environmental Resource Centers at community colleges;

8) Suggested curricula for Illinois community college degree and certificate programs;

9) Manpower study of pollution control fields in Illinois;

10) A variety of recommendations and reference materials to enhance cooperation among institutions of higher education in Illinois in environmental and every related matters.

Nearly two years have elapsed since the Illinois Board of Higher Education (IBHE) formally acknowledged receipt of the "Master Plan for Environmental/Energy Education in Illinois." The plan has largely been ignored as environmental education has been accorded little emphasis and energy education is only now beginning to assume importance. Some program recommendations in the plan have been acted upon as evidenced by the following program support funding recommendations by the Illinois Board of Higher Education staff for FY 1978:

1)	Eastern Illinois University B.S. in Business, Major in Energy Management	$ 30,000
2)	Southern Illinois University-Carbondale	
	M.S. in Mining Engineering	50,000
	Coal Extraction and Utilization Research Center	150,000
3)	Southern Illinois University-Edwardsville M.S. in Environmental Studies	50,000
4)	University of Illinois-Urbana-Champaign Institute for Environmental Studies	24,000
	TOTAL	$304,000

It should be noted that this is the recommended funding level. Actual funding may be no more than 50% of that recommended. These proposed programs were already under review by IBHE staff before the environmental/energy master plan study was begun. It is likely these programs would have been funded even had there been no master plan. Other recommendations regarding ongoing or proposed programs included in the master plan have not been acted upon.

None of the recommendations for non-curricular environmental/energy education activities (specifically the campus environmental/energy operating plans for environmental quality improvement and energy conservation, and the community college Environmental Resource Centers, have even been considered by IBHE.

The Illinois Energy Resources Commission, (IERC), is currently drafting energy-related legislation. Although several bills include components derived from recommendations in the IBHE Environmental/Energy Master Plan, little cooperation between IBHE and IERC staff has transpired.

The Illinois Institute of Technology
Chicago, Illinois

Program: Environmental Engineering (B.S., M.S., Ph.D.)

Hours required for major: Not Available
Program Inception: 1964
Staff Size: Nine (8 Ph.D.s); six teaching assistantships; and fifteen research assistantships
Enrollment: 58 masters level students; 12 Ph.D. candidates; 25 undergraduate
Graduates (1976): 18
Placement: 100%
Graduate Work: 70

Courses - Selected

(Undergraduate)

Introduction to Water Resources Engineering
Fundamentals of Water and Wastewater Treatment
Sanitary Engineering Design
Chemistry of Environmental Systems
Introduction to Air Pollution Control
Solid Waste Engineering

(Graduate)

Environmental Chemistry
Water and Wastewater Analysis
Principles of Water Chemistry
Man and His Environment
Ecology of Aquatic Systems
Biochemical Engineering
River Ecology
Eutrophication
Ecological Engineering and Systems Ecology
Environmental and Urban Systems Analysis
Systems Analysis of Water Resources and Water Quality
Physical Processes of Water and Waste Treatment
Chemical Processes of Water and Waste Treatment
Design of Sanitary Engineering Processes
Industrial Waste Treatment
Air Pollution Meteorology
Air Pollution Instrumentation and Analysis
Ambient Air Monitoring
Air Pollution Engineering
Stack Sampling and Analysis
Atmospheric Chemistry
Design of Air Pollution Control Devices

SENIOR INSTITUTIONS

Sangamon State University
Springfield, Illinois

Program: Environments and People (B.A., M.A.)

Hours required for major: Semester - (B.A.) 28, (M.A.) 32
Program Inception: 1970
Staff Size: Five (three Ph.D.s); two or three adjunct instructors each year; and two graduate assistantships.
Enrollment: 59
Graduates: 13
Placement: Over 50%

Courses - Selected

The Population Controversy
Issues in Population: Policy and Action
Wildlife Resources
People's Energy Needs
Water Resources
Biology of Water Pollution
Land and Resources Use: Environmental Analysis, Policy, and Planning
Land-Use Planning: Principles and Practices
Heredity, Evolution, and Society
Ecology and Society: Implications for Public Institutions
Ecology and People
Sociology of Natural Resources
Geography-Life Geosystems
Environmental Climatology
The Historical Geography of the United States
Midwest Rural Life and its European Background
Midwest Rural Life and its American Regional Background
Environmental History, A Problems Approach
Environmental Perception
Energy and the Environment
Environmental Policies
Citizen Action in Environmental Affairs
Environmental Law and the Citizen
Environmental Law and Illinois Government

State Legislation

ILLINOIS GENERAL

TITLE:

Environmental Protection Act
Illinois Statutes 111½

PURPOSE:

To establish a unified, state-wide program to restore, protect and enhance the quality of the environment, and to assure that adverse effects upon the environment are fully considered and borne out by those who cause them.

DEFINITIONS:

1. Agency
2. Air pollution
3. Board
4. Contaminant
5. Garbage
6. Institute
7. Open burning
8. Open dumping
9. Person
10. Public water supply
11. Refuse
12. Sanitary landfill
13. Sewage works
14. Water pollution
15. Waters
16. Municipality

ADMINISTERING AUTHORITY:

Environmental Protection Agency
Pollution Control Board

AUTHORIZATIONS:

To conduct surveillance and inspection of various pollution sources;
To enter and inspect property in enforcement of the act;
To generally enforce the act;
To issue regulations pursuant to the act;
To administer funds and act as the state lead agency in air, water, public water, noise and solid waste areas;
To administer permit programs pursuant to the act;

AUTHORIZATIONS (Cont'd):

To establish ambient air quality and emission standards;
To control potential sources of air pollution contamination;
To establish water quality and effluent limitation standards;
To control water pollution sources;
To approve construction and operation of all public water supplies;
To establish construction and sanitation standards for refuse disposal sites;
To control refuse dumping;
To regulate noise emissions and sources;
To issue permits for nuclear power facility construction.

PROHIBITED ACTS:

To allow or cause air pollution;
To operate or construct potential air pollution sources without permit;
To cause or allow open burning of refuse;
To cause air pollution from asbestos fibers;
To allow or cause water pollution;
To operate or construct water pollution sources without permit;
To violate the terms of any permit;
To fail to provide clean, safe water supplies;
To cause or allow open dumping of refuse;
To abandon any vehicle;
To conduct refuse collection or disposal without permit;
To dispose of refuse except at a solid waste facility;
To emit unreasonable levels of noise;
To violate any regulation or provision of the act.

EXEMPTIONS:

Regulations may make different provisions depending on circumstances, sources and geographical area.

PENALTIES:

General violation - fines of up to $10,000 and $1,000 per day;
Water permit violations - fines of up to $10,000 per day;
Liability imposed for damage to fish and wildlife;
Criminal penalties for water pollution violations - fines of up to $25,000 plus a misdemeanor.

ILLINOIS PESTICIDES

TITLE:

Custom Application of Pesticides Act
Illinois Statutes 5-87

PURPOSE:

To provide for the control of pesticide usage and the licensing of pesticide application activities.

DEFINITIONS:

1. Aircraft
2. Custom application of pesticides
3. Director
4. Fungicide
5. Fungus
6. Ground equipment
7. Herbicide
8. Insect
9. Insecticide
10. Nematocide
11. Nematode
12. Person
13. Pesticide applicator
14. Pesticide operator
15. Pesticides
16. Public application of pesticides
17. Public applicator
18. Public operator
19. Structure
20. Weed

ADMINISTERING AUTHORITY:

Department of Agriculture
Interagency Committee on Pesticides

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To classify pesticides and restrict their usage;
To enter and inspect in enforcement of the act;
To establish certification standards and certify commercial applicators;
To generally enforce the act.

CERTIFICATION OR LICENSING:

Restricted users must be certified in operator or applicator category; examination and showing of knowledge required.

PROHIBITED ACTS:

To engage in custom application without certification;
To violate other regulations or act provisions.

EXEMPTIONS:

Structural pest operators, governmental units, fumigators, farmers of limited application, tree experts, veterinarians, canning establishments, and general pest control operators.

PENALTIES:

First offense - fines of up to $200;
Subsequent offenses - fines of up to $400.

ILLINOIS POTABLE WATER

TITLE:

Water Supply Operator Certification Law
Illinois Statutes 111½-501

PURPOSE:

To safeguard the health of the people and control the public water supplies of the state.

DEFINITIONS:

1. Water supply operator
2. Public water supply
3. Agency
4. Director
5. Advisory board
6. Owner or operator

ADMINISTERING AUTHORITY:

Environmental Protection Agency
Water Supply Operators' Advisory Board

AUTHORIZATIONS:

To establish water supply operator certification standards;
To certify water supply operators;
To enforce the act.

CERTIFICATION OR LICENSING:

Water supply operators must be certified according to four classifications; qualifications set forth and examination is required.

Provision made for prior operators and other certificate holders.

PROHIBITED ACTS:

To operate a public water supply without certified operator;
To violate terms of a certificate

PENALTIES:

Fines of from $100 to $1,000.

ILLINOIS RADIATION

TITLE:

Radiation Installation Registration Law
Illinois Statutes 194

PURPOSE:

To provide for the control and registration of all radiation installations in the state.

DEFINITIONS:

1. Radiation
2. Radiation machine
3. Radioactive material
4. Radiation installation
5. Operator
6. Sealed source
7. Department
8. Director
9. National Committee on Radiation Protection

ADMINISTERING AUTHORITY:

Department of Public Health

AUTHORIZATIONS:

To require registration of all radiation installations;
To inspect and investigate installations to enforce the act.

PROHIBITED ACTS:

To fail to register radiation installation as required;
To violate any act provisions.

EXEMPTIONS:

Low-level, non-harmful or some natural radioactive sources.

PENALTIES:

Violation constitutes misdemeanor.

ILLINOIS RADIATION

TITLE:

Radiation Protection Act
Illinois Statutes 211

PURPOSE:

To provide for the effective regulation of radiation sources and to permit maximum utilization of sources of ionizing radiation.

DEFINITIONS:

1. By-product material
2. Department
3. Director
4. General license
5. Person
6. Radiation
7. Radiation installation
8. Radiation machine
9. Radioactive material
10. Radiation source
11. Source material
12. Special nuclear material
13. Specific license

ADMINISTERING AUTHORITY:

Department of Public Health
Radiation Protection Advisory Council

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To license by-product, source and special nuclear materials;
To register other radiation sources;
To enter into agreements with state and federal agencies;
To develop a comprehensive radiation control program;
To require radiation exposure records;
To issue abatement orders.

PROHIBITED ACTS:

To intentionally administer radiation to human being;
To violate the terms of any license;
To violate any provision or fail to perform any duty under the act.

EXEMPTIONS:

Physicians, dentists, and chiropractors.

PENALTIES:

Violation constitutes misdemeanor.

NRC AGREEMENT STATE: No